the OIL AND GAS JOURNAL

Why Hughes assures you the right bits at the right time

The clockwork delivery of HUGHES bits to your rig is assured before you spud in.

This is made possible by the 400-man HUGHES field service organization working closely with operators in every drilling area in the United States and Canada. Their combined estimates become the basis on which HUGHES' manufacturing schedules are set up.

That's why bits of the correct sizes and types move into our strategically located warehouses well in advance of actual requirements . . . and why you can depend on your HUGHES field service man to have the right bits on your rig at the right time.

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Greetings from Halliburton

the OIL AND GAS JOURNAL

DECEMBER 6, 1954 VOL. 53 NO. 31

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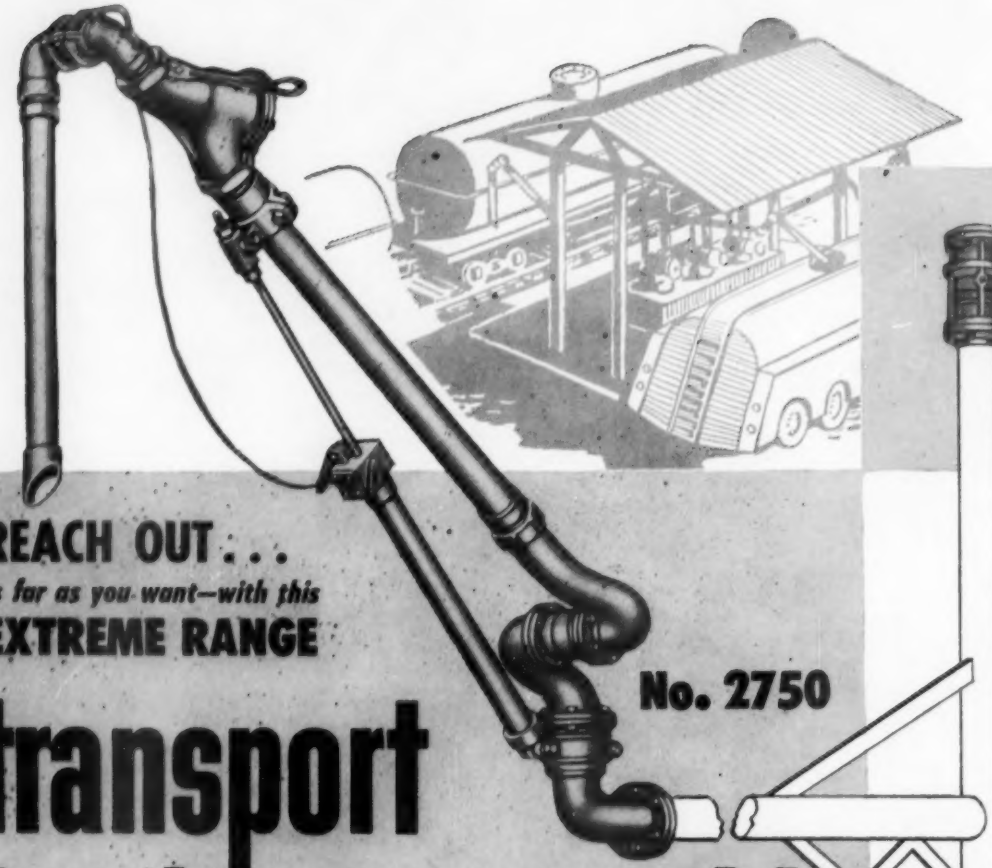
In Brief . . .

1. FIELD TESTS . . . A five-spot well pattern is being used for a second series of field tests of the in situ combustion process of oil recovery. These tests are under way in the same field of Jefferson County, Oklahoma, in which Magnolia's initial work was carried out a year ago. Principal objective of the current tests is to establish a relationship between field observations and computations. Results of this work should enable a realistic, economic appraisal of the process. Significant refinements in techniques of operation are expected.

2. CHEAPER DRILLING . . . To reduce costs and to meet competition, the drilling industry is turning to trailer-mounted or self-propelled drilling rigs wherever possible. In the shallow producing areas, time required to drill a well is about the same using either mobile or conventional skid-mounted rigs. Moves in these areas may represent 10 per cent of the total time necessary for drilling a well. Time saved with mobile equipment can give the contractor a decided edge on his competitors.

3. METERING BIG STREAMS . . . The accuracy and reliability of positive-displacement meters in crude service has been proved at a number of Magnolia's installations. Meters are now being used for custody or accounting transfer of crudes from several lines, and the operation presents fewer problems than comparable product metering. Gravimetric-type proving equipment has proved highly successful in providing quick, reliable meter calibrations.

4. SUCCESSFUL STORAGE . . . Evacuated underground storage for petroleum products has now been used for 5 years with an outstanding success record. It may be used in several geological environments where other types of underground storage cannot. It is adaptable to storage of gases, liquefied petroleum gases, and liquids. For increased usage, the method needs further development in site investigation and in means of sealing permeability. Investigations are currently being carried out along these lines.



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Minimum fill up time . . . no truck respotting . . . at loading racks where OPW's No. 2750 Transport Loading Assemblies are installed. The extreme range, overall compactness, and maneuverability makes the difference . . . provides a really effortless, flexible loading of tank cars and trucks.

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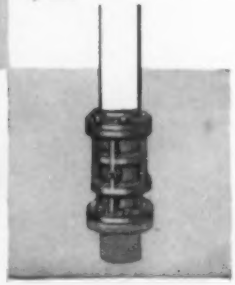

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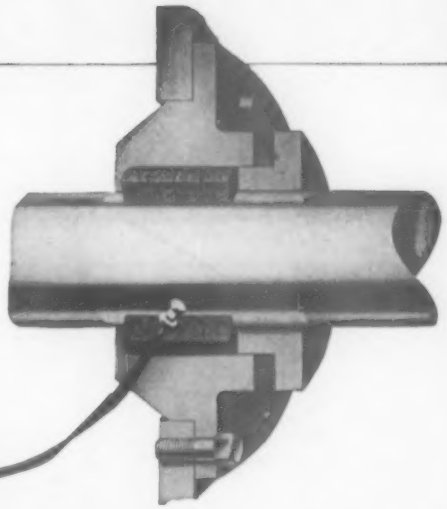
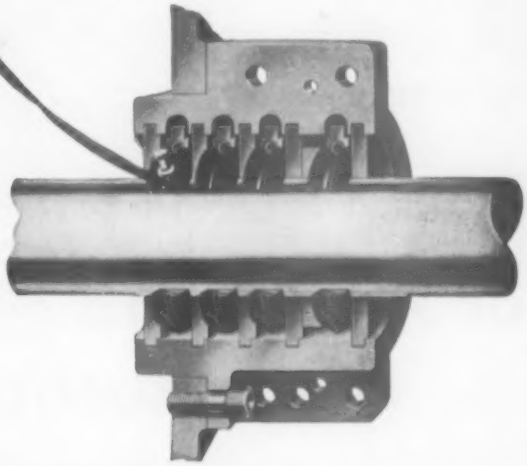


STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

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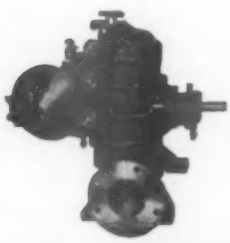
When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .



WRITE FOR BULLETIN 135
COPPUS ENGINEERING CORPORATION
273 Park Avenue
Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

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SERVICE

that is saving dollars...

IN RECONDITIONING customer's pumps at "Oilwell's" Odessa, Texas, pump shop, old balls and seats are carefully checked for accuracy of mating under vacuum.

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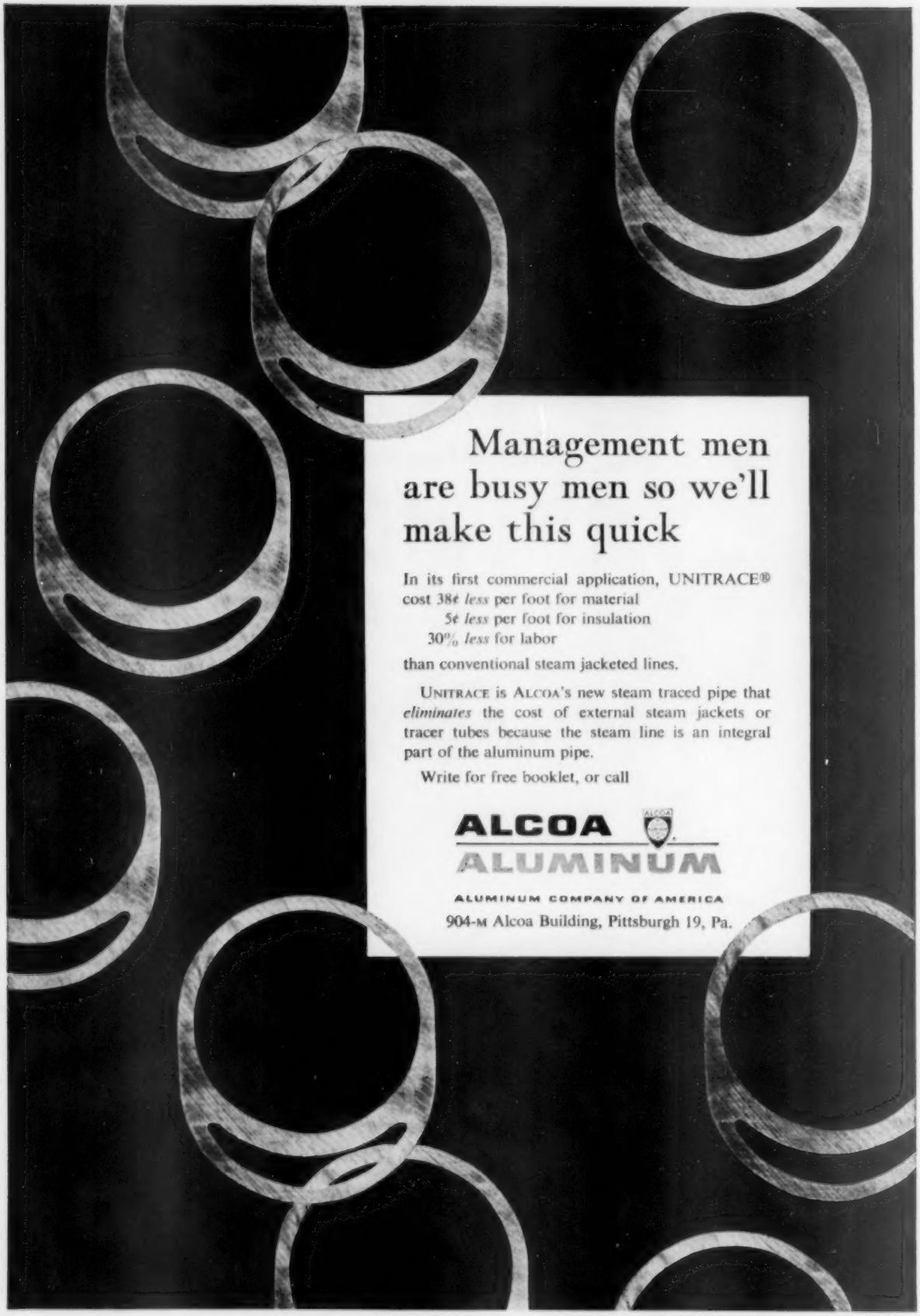
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Price measures cheapness, not value

Everyone nowadays is bedeviled by the higher cost of things . . . so you can't really blame a man for buying on price.

"Save a dollar on a valve here, a few cents there—it all adds up."

But time so often tells a different story, when the dollar *saved* goes out the window in excessive piping maintenance costs. And this can run into a mighty big outlay when you consider the number of valves in a typical plant. Then it's easy to appreciate the great, good wisdom in buying valves and piping equipment of known quality, known dependability.

That's when you become a thrifty buyer—when you buy for value, and not for dubious savings . . . when you buy Crane for the lasting service you get, and the lower upkeep cost.

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CRANE

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This CAT* No. 12 Motor Grader is a good investment

Owner Lee Boyd of Bakersfield, California, knows oilfields. That's why he has this drill site preparation job at Coles Levee Field near Bakersfield. He also knows equipment. That's why he has this big Cat Motor Grader on the job.

There are a number of hard-headed business reasons why Caterpillar Motor Graders are standard equipment in America's oil patches. They all add up to heavy savings in time and money.

Consider the all-around usefulness of the Caterpillar Motor Graders. They can level sites and grade, as the machine is doing in the picture. They can build new access roads and maintain old ones.

And they do these things without breaking down when you need them most. Long life is built into these big yellow workhorses. The box sections on circle and drawbar, for instance, are the heaviest and strongest ever used on any grader—weighing 35 pounds per foot.

Their powerful diesel engines are designed specifically for their use. Weight, horsepower, traction and working speeds of all three models are properly balanced. *One* manufacturer makes the frame, engine, transmission, final drive, circle, drawbar and mechanical controls.

No wonder that of all Caterpillar Motor Graders ever built, 99 per cent still are in service!

Ask your operators—they like the visibility, accuracy and comfort of Caterpillar Motor Graders. Ask owners—their money-saving experience is this equipment's best selling point. Ask your Caterpillar Dealer—he'll be happy to demonstrate on your job.

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

Pump supplies pressures up to 1000 pounds; TIMKEN® bearings keep pinion and crankshaft in line

THE "Oil-Rite" horizontal triplex pump pictured here in use in the Oklahoma oil fields is designed for high pressure work where a dependable, automatically oiled pump is required. To make sure it delivers smooth, trouble-free performance with minimum time-out for maintenance, The Deming Company mounts the pinion and crankshaft on Timken® tapered roller bearings.

Timken bearings on the crankshaft take both radial and thrust loads, hold the shaft in proper alignment, minimize deflection and end-play. There's less wear on related parts—less time lost in repairs. Timken bearings on the pinion shaft carry the heavy gear loads—insure accurate, smooth gear mesh. Result: longer gear life, smoother flow of power.

Timken bearings hold housings and shafts concentric, making closures more effective. Lubricant is kept in—dirt and moisture kept out. And due to their true rolling motion and smooth surface finish, Timken bearings practically eliminate friction, reduce wear.

Be sure to specify Timken bearings in the machines you build or buy. They give longer life with minimum maintenance. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, O. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

THE DEMING COMPANY mounts the pinion and crankshaft of its "Oil-Rite" horizontal triplex pump on Timken tapered roller bearings for long life, minimum maintenance.

DESIGN LEADERSHIP

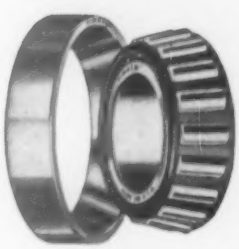
The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roller ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

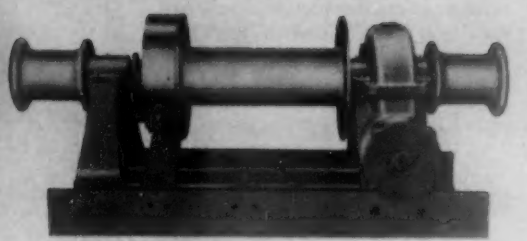


NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬮ AND THRUST ⬮ LOADS OR ANY COMBINATION ✳

and Power to SPARE

IT'S A

Tulsa* Winch



Tulsa Winches are available for every make and model truck and crawler tractor in capacities from 6,500 to 80,000 lbs.

. . . And because it's a Tulsa Winch, you can be sure that each component part is engineer-designed. This precision is a "must" when you're depending on close control and positive power to move or load, lift or lower costly equipment. For detailed information and prices, contact your Tulsa Winch distributor or write . . .

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TULSA, OKLAHOMA
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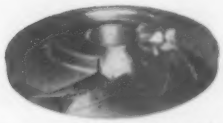
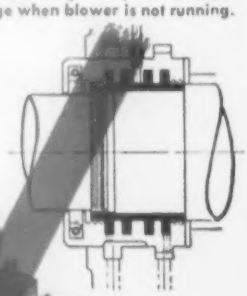
Multi-Stage Centrifugal Blowers

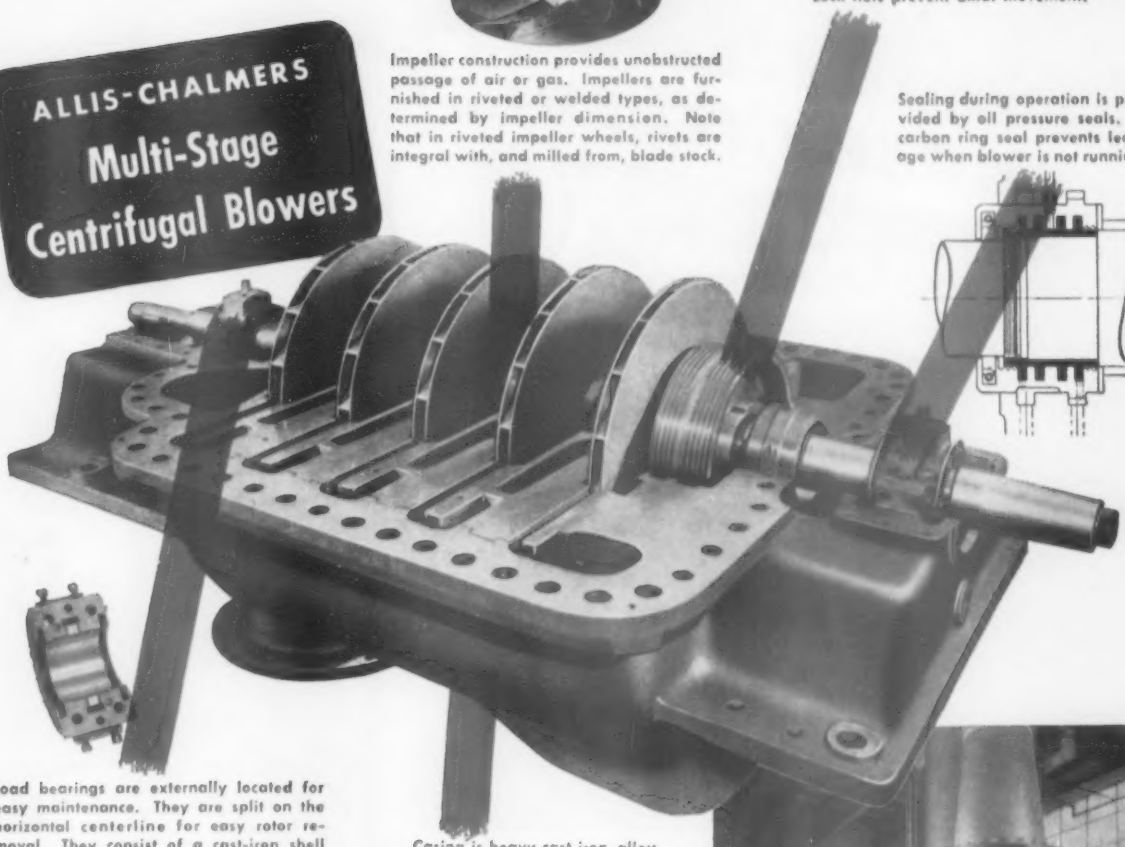


Impeller construction provides unobstructed passage of air or gas. Impellers are furnished in riveted or welded types, as determined by impeller dimension. Note that in riveted impeller wheels, rivets are integral with, and milled from, blade stock.

Impeller wheels are located accurately on shaft with sleeves and are mounted with light shrink fit. Bores are ground to size. Lock nuts prevent axial movement.

Sealing during operation is provided by oil pressure seals. A carbon ring seal prevents leakage when blower is not running.





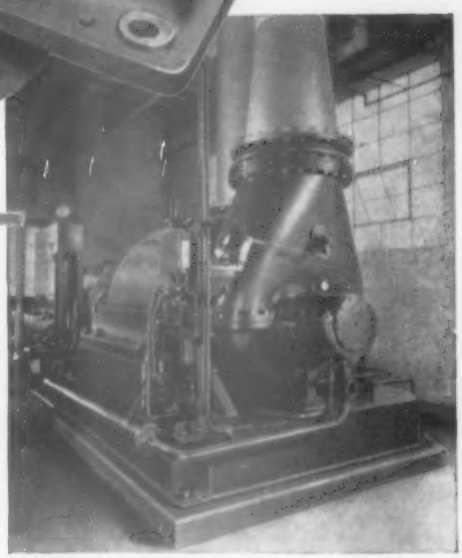
Load bearings are externally located for easy maintenance. They are split on the horizontal centerline for easy rotor removal. They consist of a cast-iron shell with removable, babbit-lined steel inserts.

Casing is heavy cast iron, alloy, or forged steel.

Why these blowers can run for years *without stopping*

The key to "round the clock" performance in fluid catalytic cracking plants is *quality*, as illustrated in the features above.

For highly dependable, low maintenance air and gas handling equipment, as well as motors and control, call your nearby Allis-Chalmers office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4465



This Allis-Chalmers four-stage centrifugal blower supplies 24,000 cfm to the catalytic cracking tower of an eastern refinery on a 24-hour-a-day basis, month in and month out.

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GREATER EFFICIENCY
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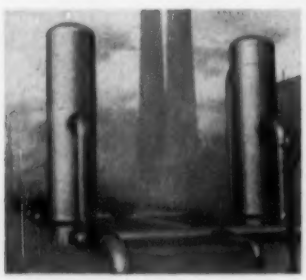
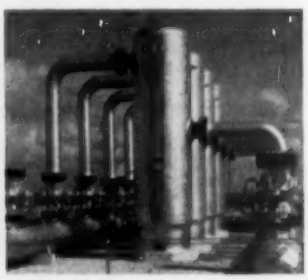
These units have equally high efficiency at low or high gas flows. This efficiency is maintained whether a fine entrainment or slugging problem exists.

Through the use of the famous Peerless Mist Extractor Unit, now serving so efficiently in scrubbers, fractionators, absorption towers, refineries, and gasoline plants throughout the world, Peerless can build their scrubbers smaller than most scrubbers of other makes and... PEERLESS CAN GUARANTEE THE PERFORMANCE OF THESE SCRUBBERS! THEY ARE GUARANTEED TO REDUCE ENTRAINMENT LOSS TO LESS THAN 1/10 GALLON PER MILLION STANDARD CUBIC FEET OF GAS!



Two Peerless 48 x 19 Scrubbers, each handling 50 million CFPD at 250 PSI on inlet of a power plant in South Texas.



FOUR Peerless 60" x 19" Scrubbers handling a total of 132,000,000 CFPD at 600 PSIG. working pressure. Located at new pipeline compressor station.

Shown above is a cutaway of a Peerless Vertical Scrubber. This illustration indicates the path followed by the gas stream as it passes through the scrubber.

Peerless Precision Engineered Scrubbers available in vertical or horizontal sizes or can be built to your requirements... FOR ANY GAS FLOW... FOR ANY WORKING PRESSURE.

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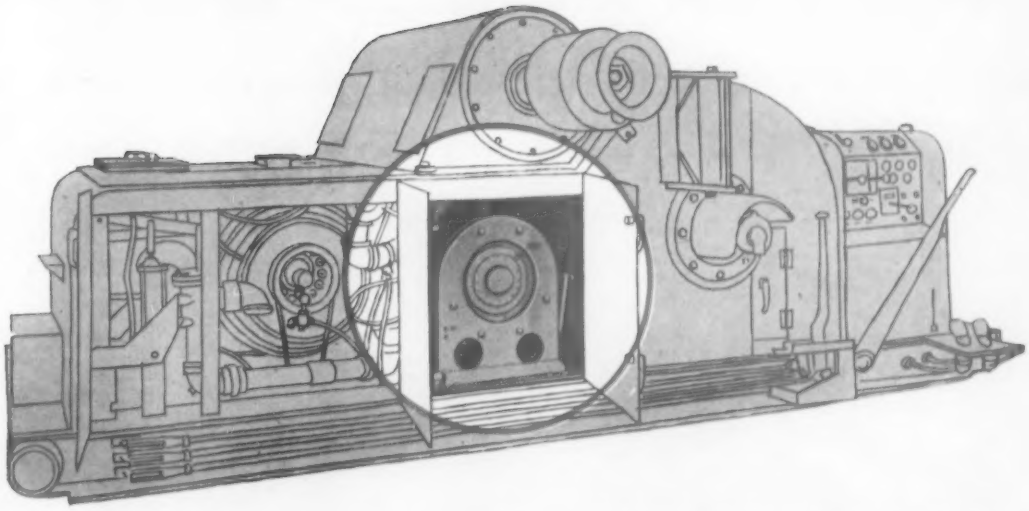
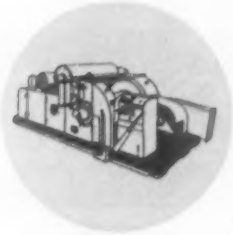
UNIT RIG'S
HYDROMATIC BRAKE
is an integral part of the draw works . . . .
AS IT SHOULD BE!



UNIT RIG'S Hydromatic Brake is built into the draw works . . . it is NOT a separate package. This integral unit, with built-in piping, is readily accessible.

The brake is driven from the jackshaft through a clutch. It is equipped with UNIT RIG'S exclusive variable flow control and dump valve assembly to provide fast pipe fall with maximum braking power as desired. This feature keeps trip time to a minimum.

The UNIT RIG built-in Hydromatic Brake is just one more reason why your next draw works should be a UNIT RIG.



UNIT UNIT RIG

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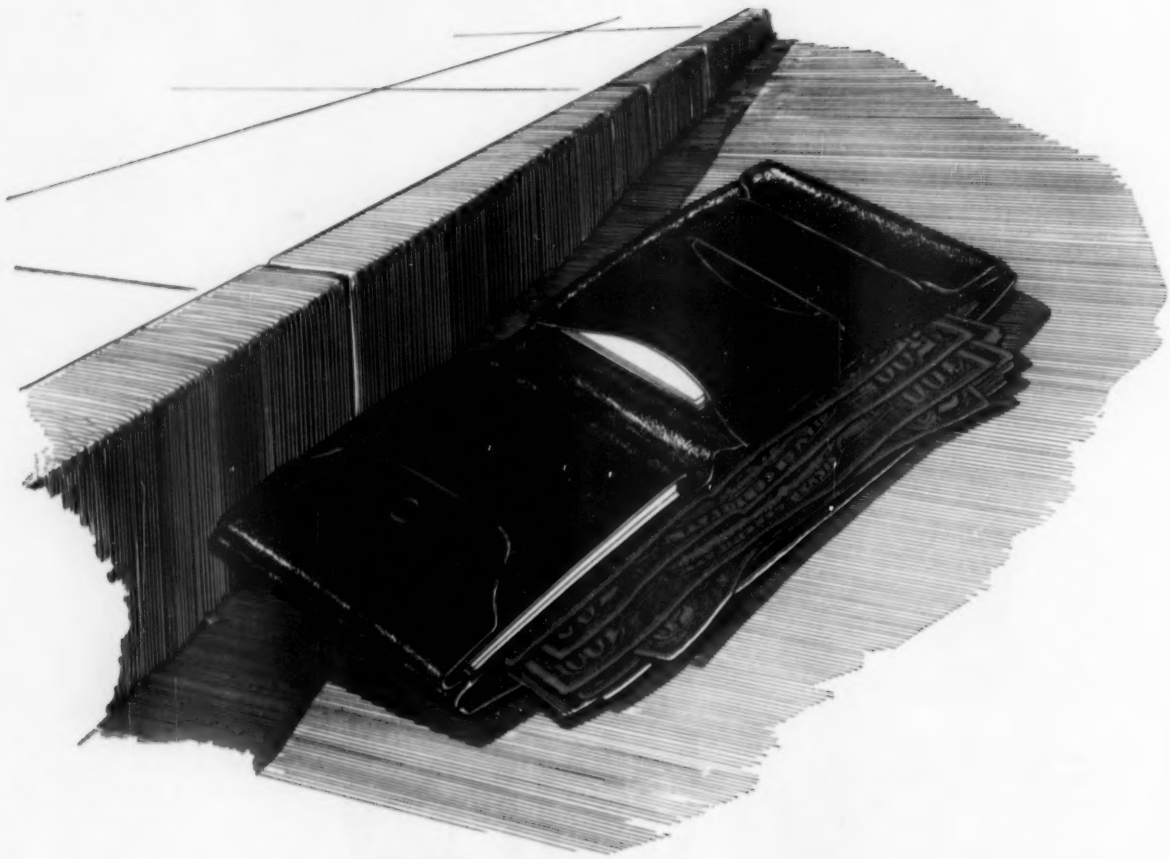
A-5410

Like finding $5775 on the street!



. . . that's what the

FREE SCAVENGING

of each Clark Turbocharged Compressor can save you annually in fuel alone

$5775 a year? Sounds like a lot of money to save on fuel for *every compressor you install* . . . but it's a fact!

Based on 20¢ fuel, a Clark Turbocharged Model TLA-10 Gas-Engine-Driven Compressor, rated at 3300 bhp, will save you $5775 per year compared to a high-compression, non-turbocharged, conventionally scavenged unit. Other Clark Turbocharged Compressors show comparable savings.

How are such large savings possible? With Clark Turbocharged Compressors, there is *no need* to drain power from the engine crankshaft for pumping scavenging air. Instead, the Clark Turbocharger uses "waste" exhaust gases to pump scavenging air free of charge. The resulting savings in fuel are enhanced even more by the high thermal efficiency of these new turbocharged units.

Free scavenging is only one of the many ways that Clark Turbocharged Compressors will save you money. Ask any Clark representative to prove it to you. Bulletin 134 provides valuable details. Write.

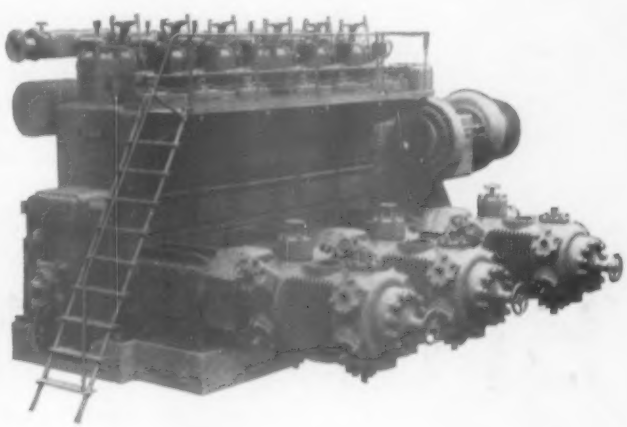
CLARK BROS. CO. • OLEAN, N. Y.

ONE OF THE DRESSER INDUSTRIES

Sales Offices in Principal Cities Throughout the World

CLARK®

COMPRESSORS



Clark sets the pace in compressor progress

WHATEVER YOUR METERING PROBLEM

BRODIE EXPERIENCE & SERVICE ...AT HAND'S REACH

in all principal cities and areas—coast to coast

Whether you operate a single meter or many meters... in a local area or throughout the country... you'll find that Brodie meets all of your basic requirements:

1. A thoroughly trained and experienced organization fully qualified to help you work out your metering problems.
2. Service facilities conveniently located in all principal cities.
3. Efficient meters and accessories that have built a reputation for high sustained accuracy and low maintenance.

Why not avail yourself of the knowledge and assistance your nearest Brodie Meter Specialist can provide. He's as near as your telephone.

A complete range of meter sizes, types and accessories... for every petroleum metering need

BRODIE BiRotor METERS

ALL-STEEL TRUE-ROTARY

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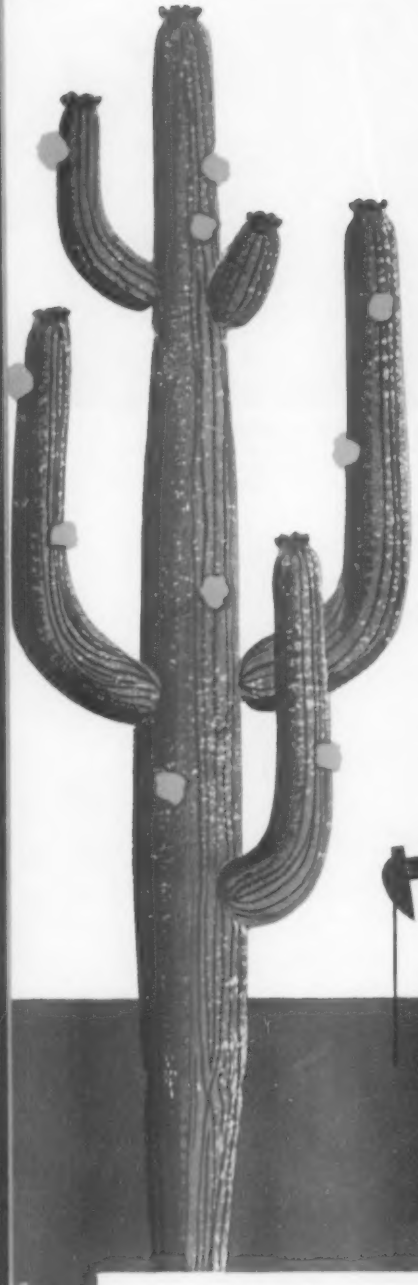
REPRESENTATIVES WITH STOCKS AND SERVICE FACILITIES IN ALL PRINCIPAL CITIES



Block Buster!

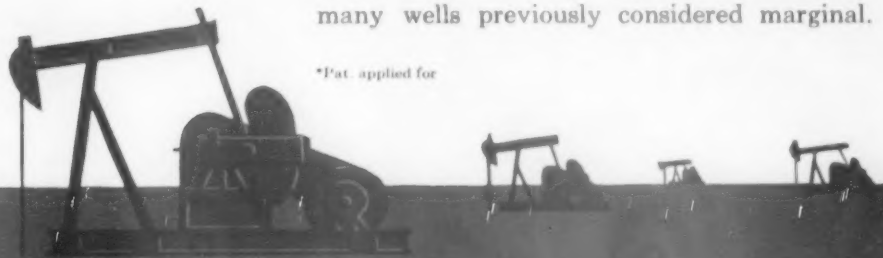
ATPET 931 revives water-damaged wells

Water blocks which have cut off or reduced production are now being removed at low cost by the use of ATPET 931, a unique interfacial tension depressant made by Atlas Powder Company. A process* developed by Stanolind Oil & Gas Company makes use of this chemical to stimulate old wells, to restore dead wells, and to complete new wells that are subject to water damage.

This process consists of injecting field crude containing about 1% ATPET 931 into the oil formation. By reducing the interfacial tension between oil and water practically to zero, this new chemical breaks water blocks and permits oil flow through the strata.

Payout is fast. Amortization time is measured in days . . . instead of months. The process costs exceptionally little, and permits economical stimulation of many wells previously considered marginal.

*Pat. applied for



ATPET 931 is non-ionic; gives excellent performance in the presence of oil field waters and brines, and has little tendency to plate out on solid surfaces. Write your nearest Atlas office for samples and further information.

BOSTON, MASS.
405 Garden Building
250 Boylston Street
KEnmore 6-7817

CHICAGO, ILLINOIS
1605 Field Building
135 S. LaSalle Street
FRanklin 2-9530

HOUSTON, TEXAS
Suite 128
3272 Westheimer Rd.
Justin 5561

LOS ANGELES, CALIFORNIA
805 Title Guarantee Building
411 West Fifth Street
Michigan 8896

NEW YORK, N. Y.
60 East 42nd Street
VAnderbilt 6-1730

ST. LOUIS, MO.
402 Continental Bldg.
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JEfferson 3-2538

SAN FRANCISCO, CALIF.
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CHEMICALS DEPARTMENT
ATLAS POWDER COMPANY
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ATLAS POWDER COMPANY, CANADA, LTD.
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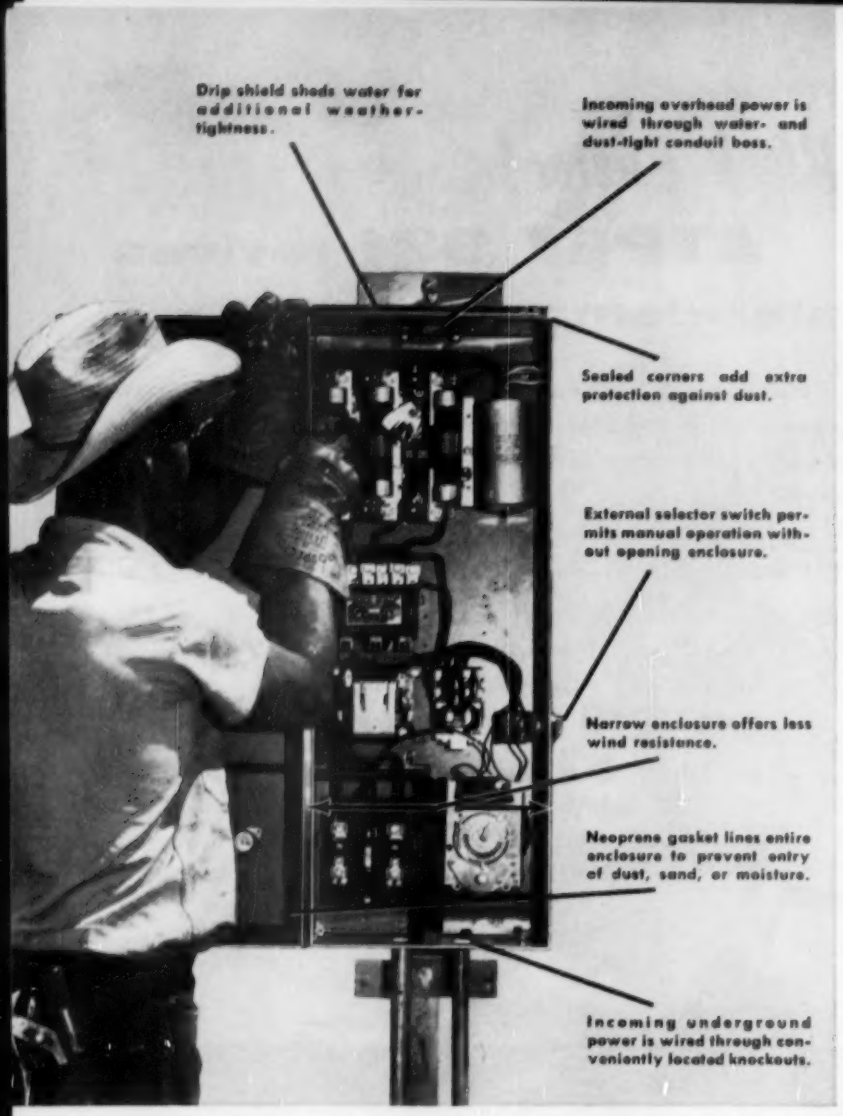
Drip shield sheds water for additional weather-tightness.
Incoming overhead power is wired through water- and dust-tight conduit boss.
Sealed corners add extra protection against dust.
External selector switch permits manual operation without opening enclosure.
Narrow enclosure offers less wind resistance.
Neoprene gasket lines entire enclosure to prevent entry of dust, sand, or moisture.
Incoming underground power is wired through conveniently located knockouts.

BETTER OPERATOR PROTECTION provided by external dust-tight selector switch for manual use in event of non-cyclical pumping. Complete grounding also protects the operator.

SIMPLIFIED WIRING to the pump motor is achieved by availability of two knockouts at bottom of ventilated relay compartment. Too, there is plenty wiring space for incoming power.

JUST WHAT OIL-FIELD OPERATORS NEED . . .

NEW G-E OIL-WELL PUMPING STARTER

More Protection • Versatile Design • Dependable Operation

The new General Electric oil-well pumping starter was designed according to oil industry specifications. Oil-field operators asked for maximum protection against breakdowns and ease of mounting, wiring, and operation. This new starter meets these requirements.

PROTECTIVE FEATURES are headed by a neoprene gasket which lines the door of the enclosure. It helps keep dust and sand from coating contacts and other sensitive parts, assuring dependable control of pumping cycles.

The combination of gasketed enclosure and a separate, ventilated relay compartment is a G-E exclusive. It helps prevent bi-metallic overload relays from tripping prematurely due to heat from the sun.

HIGHLY VERSATILE for both mounting and wiring, the new starter is designed to fit any pole mounting. It is equipped with mounting plates for key- or U-bolt attachment. Its narrow design also has less wind resistance, minimizing storm damage.

With watertight conduit boss at the top and knockouts at the bottom of its case, the starter is easily wired for overhead or underground incoming power.

COMPLETELY GROUNDED by its own lightning arrester and ground, the starter also has a grounding provision for a power-factor correction capacitor. To ground the capacitor, merely mount a stud to the starter enclosure.

FOR MORE INFORMATION contact your nearest G-E Apparatus Sales Office or Distributor, or write to Section 730-57, General Electric, Schenectady 5, N. Y. Ask for bulletin GEA-6153.

GENERAL ELECTRIC

"aren't all steel plates alike?"

That's what some steel buyers think. But, take it from us at Claymont, it just isn't so! Or take it from the men in your fabricating shop. They know that—while many plates look alike—some are easier to work. They'll tell you, also, that Claymont plates save you money because your shop can do a better job.

You'll always find Claymont carbon and alloy plates among these preferred plates because they are tailored to your individual requirements. Right down the line your order gets personalized attention as it is processed through our sales office, checked by our metallurgists, produced by our skilled craftsmen, tested for proper physical and chemical properties by our laboratories and shipped to you *on time*.

TO ORDER—Contact our nearest sales office or write direct to Claymont Steel Products Department, Wickwire Spencer Steel Division, 813 West Street, Wilmington 99, Delaware.

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don't
strain his back
lifting heavy valve cover
plates on most
big mud pumps!"
do
use Gardner-Denver Mud
Pumps with two-piece
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Gardner-Denver GX Series Mud Pumps are designed to make maintenance simpler, easier and safer:
1. Completely interchangeable fluid cylinder.
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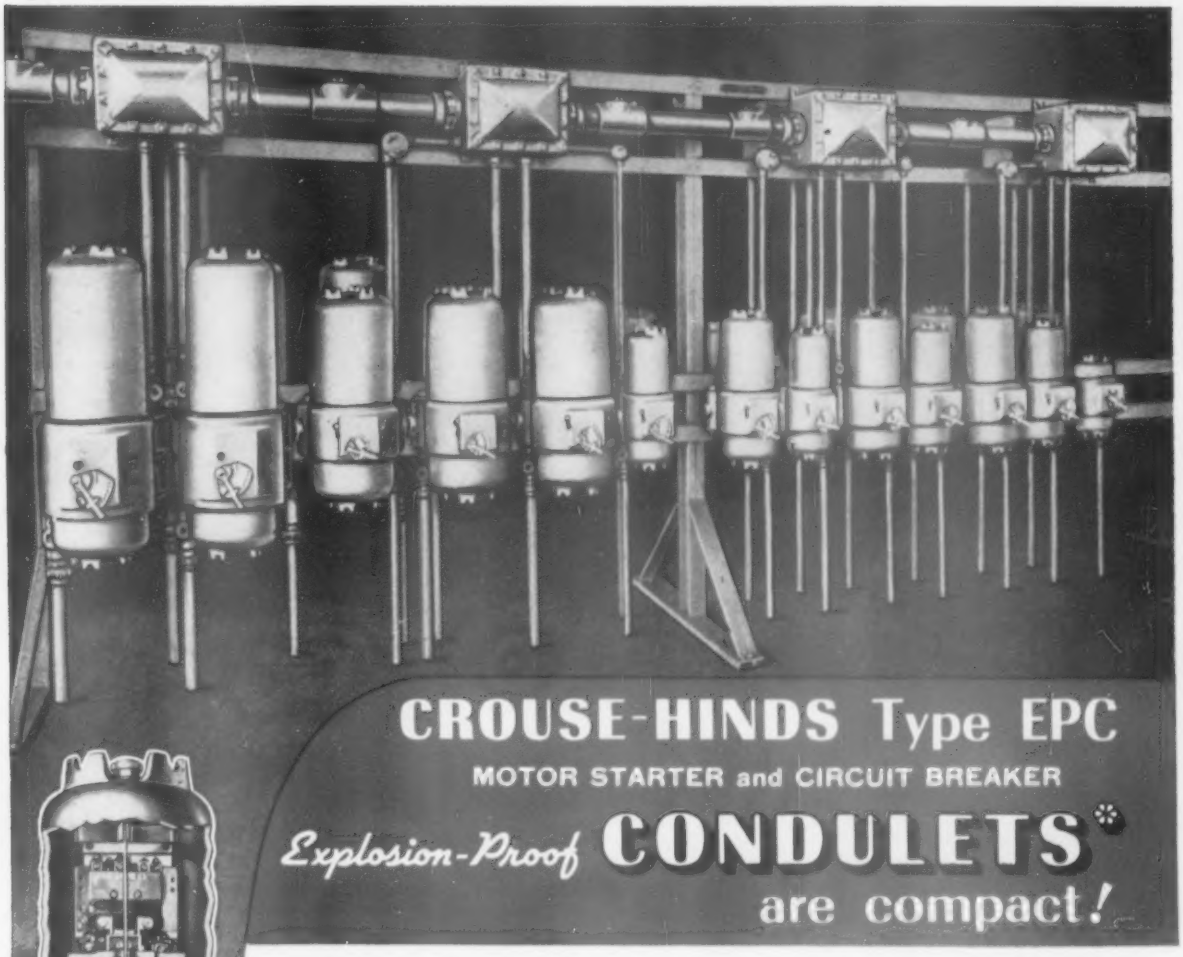
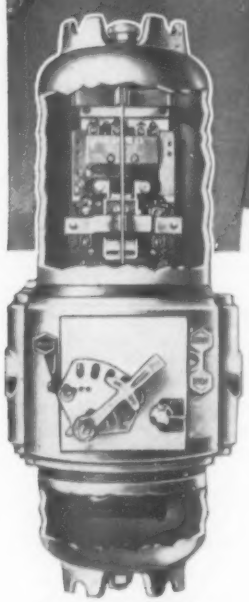
CONTINENTAL
Serving the Oil and Gas Industries



CROUSE-HINDS Type EPC

MOTOR STARTER and CIRCUIT BREAKER

Explosion-Proof CONDULETS* are compact!



Type EPC Combination Line Starter Conduit with Broken-Away Covers Showing Interior Starter and Circuit Breaker Assembly

Little space required for a big installation

Crouse-Hinds exclusive vertical cylindrical design conserves horizontal space that is always at a premium, speeds up installing and wiring, and saves money on the construction of steel mounting racks.

- **Explosion-proof, dust-tight,** and **weather-resistant** (raintight).
- **Light-weight cast aluminum** — for easy installation and maintenance. No lifting equipment required. Saves time and money.
- **Flame-tight threaded joints** throughout — the type of construction that was pioneered by Crouse-Hinds. Covers are taper-threaded with seven threads for extra safety. Operating shafts and bushings are thread-in-thread construction.
- **Seven conduit entrances** — give you the choice of either vertical or horizontal "through feed", "U" at either top or bottom, "T", or "L" at either side or back. Saves money by simplifying installation. Large central body — for easy wiring.
- **Built-in push button stations** and built-in selector switch are available.
- **Versatile.** Wide selection of well known controls. Starter sizes 0 to 5. Circuit breakers 50 to 600-Amp. frame sizes.
- The Crouse-Hinds Type EPC advantages all add up to **lower installed cost** and **lower maintenance cost.**

*CONDULETS are made only by CROUSE-HINDS

A Nationwide Distribution Through Electrical Distributors

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Very

SATISFACTORY SERVICE . . . .

What

POLICYHOLDERS *Say*

This is one of many testimonial letters received from policyholders of the Texas Employers Insurance Association. These letters tell what policyholders think of the Service and Savings received from the Association.

Ask the Texas Employers representative nearest you to show you more of these letters, as proof of what Texas' largest writer of Workmen's Compensation Insurance can do for you.

40TH ANNIVERSARY 1914-1954

. . . from all DEPARTMENTS

"We wish to thank you for the dividend check received from you in the amount of $2,965.43, which represented 35.8% of premiums paid by us.

"We wish to state also that we have received very satisfactory service from all departments of your company with which we have been in contact. All claims have been promptly and fairly handled, and our requests to your staff for coverage certificates, etc., have been taken care of quickly and efficiently.

"We ourselves, as well as our business associates, are well pleased with the service you have given us."

Largest Writer of WORKMEN'S COMPENSATION INSURANCE *in Texas*

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HOME OFFICE · DALLAS, TEXAS

"WORLD'S LARGEST TRUCK"

VICKERS HYDRAULICS

Dart Model 60 Truck is shown carrying full 75-ton payload.

This Dart behemoth with a gross vehicle weight of 240,000 lb is said to be the largest truck in the world. It has two engines totaling 700 horsepower. Everything about it is on a colossal scale.

A new hydraulic circuit was developed by Vickers expressly for Model 60. The driver steers this truck with no more effort than he would a passenger car as the steering gear merely actuates the valve that controls the flow of oil to the steering cylinders. Twin cylinders provide 50,000 lb steering force (at 1000 psi oil pressure) for the dual front wheels.

Dart is thoroughly familiar with the many advantages of Vickers Hydraulic Power Steering having used it since 1938.

Vickers hydraulic equipment is available for all types and sizes of mobile equipment. Ask for new Catalog M-5101.

Vickers hydraulic power dumps the load; twin hoists are rated at 130,000 lb push at 1000 psi oil pressure.

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REPRESENTATIVE STANDARD VICKERS UNITS USED ON DART MODEL 60

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

THE PROOF IS IN THE FIELD . . .

Carter

Long-stroke Hydraulic Pumping Units

Featuring the amazing Variable-Cycle Principle

Designed — Built — Priced FOR STRIPPER WELLS

CALIFORNIA

Carter Unit Pumping in Edna Field. Has been in service for seven years.

KANSAS

One of 4 units in the Great Bend Area, pumping from 3400 ft., owned by large independent.

EAST TEXAS

One of 8 Carter Units owned by a major oil company in Kilgore and Turnertown Areas. Pumping allowable from 3500 ft. Total cost about 60% of the cost of a conventional unit.

OKLAHOMA

Seven units owned by an independent in the Tulsa Area, pumping from about 1500 ft. Operator reports production holding up better than offsetting wells with conventional units.

KENTUCKY

Carter unit on 15-ft. substructure in the Green River Bottoms. Operator saved about 50% on substructure cost alone. This is one of seven units owned by this independent.

NORTH TEXAS

Carter Unit completely installed in Caddo Field, pumping 30 bbl/day from 6250 ft. No rod failures in more than a year's operation. Total cost about 50% of the cost of a conventional unit.

CANADA

Carter Unit operating in 40 degree-below-zero weather in the Carbondale Field, showing adaptability of Carter Unit to extreme climatic conditions.

SOUTH TEXAS

Production increased from 2½ bbl/day to 6 bbl/day on this 2700-ft. well in the Duval County Area, when it replaced conventional equipment. This is one of 11 units owned by this independent.

WEST TEXAS

Carter Unit in the Spraberry Area, pumping from 7000 ft. This unit was installed for about 30% of the cost of a conventional unit.

MORE THAN 800 UNITS NOW IN SERVICE!
MORE THAN EIGHT YEARS OF FIELD EXPERIENCE!

From Canada to the Gulf, from Ohio to the Pacific, Carter Long-Stroke Hydraulic Pumping Units are saving thousands of dollars, for majors and independents alike, through lower first cost and maintenance as well as increasing production in many cases.

WRITE FOR BULLETIN PR-253

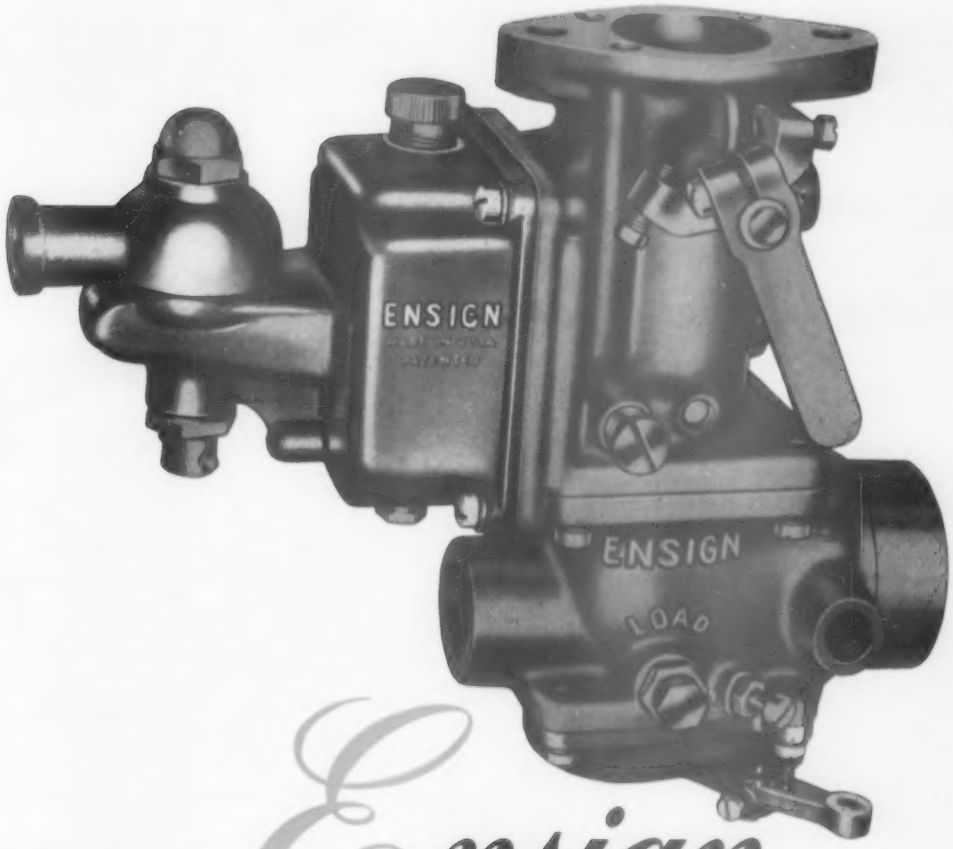
S. C. CARTER COMPANY, inc.

1900 Santa Fe Avenue • Los Angeles, California

Sales and Service Representatives in —

[illegible] Salem, Ill.; Princeton, Evansville, Ind.; Irvine, Oil Springs and Greensboro, Ky. KANSAS, OHIO, and WEST VIRGINIA—Buckeye Supply Company, Arkansas City, Chase, El Dorado, Great Bend, Wichita, Kansas; Woosster, Zanesville, [illegible] Vienna, W. Va. MICHIGAN—The Steketee Supply, Mt. Pleasant. OKLAHOMA—Wilson Supply Company, Tulsa; G. & G. Machine & Equipment Co., Henryetta. ARKANSAS, LOUISIANA, NEW MEXICO and TEXAS—Wilson Supply Company, Harvey, Houma, Lake Charles, New Iberia, Shreveport, La.; Alice, Bardwell, Bay City, Beaumont, Columbus, Corpus Christi, Houston, Kilgore, Liberty, Mumbles, and Victoria, Texas; Pearce Supply Company, Borger, Pampa, Texas. ROCKY MOUNTAIN AREA—Swan Specialties Co., Casper, Wyo.; Emrich Oilfield Management Co., Grand and Cut Bank, Montana.

EXPORT: CANADA—Engineering Specialties Co., Edmonton; COLUMBIA and VENEZUELA—Walter S. A., Caracas, Maracaibo and Puerto la Cruz. TRINIDAD—Wilson and Johnstone Ltd., Port of Spain.

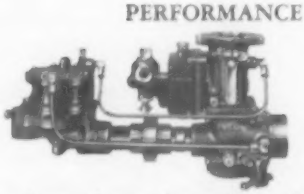


there's this about Ensign

Why is it that on over 95% of all gas engines you'll find ENSIGN carburetors? The man in the field is largely responsible for this phenomenal acceptance. On his shoulders rest the responsibility for dependable uninterrupted gas engine performance. And to him engine and oil equipment builders look for actual field proof of good carburetor performance. By reducing engine failures to a minimum, ENSIGN has helped this man do his job well and efficiently.

WORLD WIDE ACCEPTANCE

Yes, there's this about ENSIGN. You expect good PERFORMANCE — you get good PERFORMANCE.



ENSIGN CARBURETOR COMPANY

7010 S. Alameda St., Box 229, Huntington Park, Calif.
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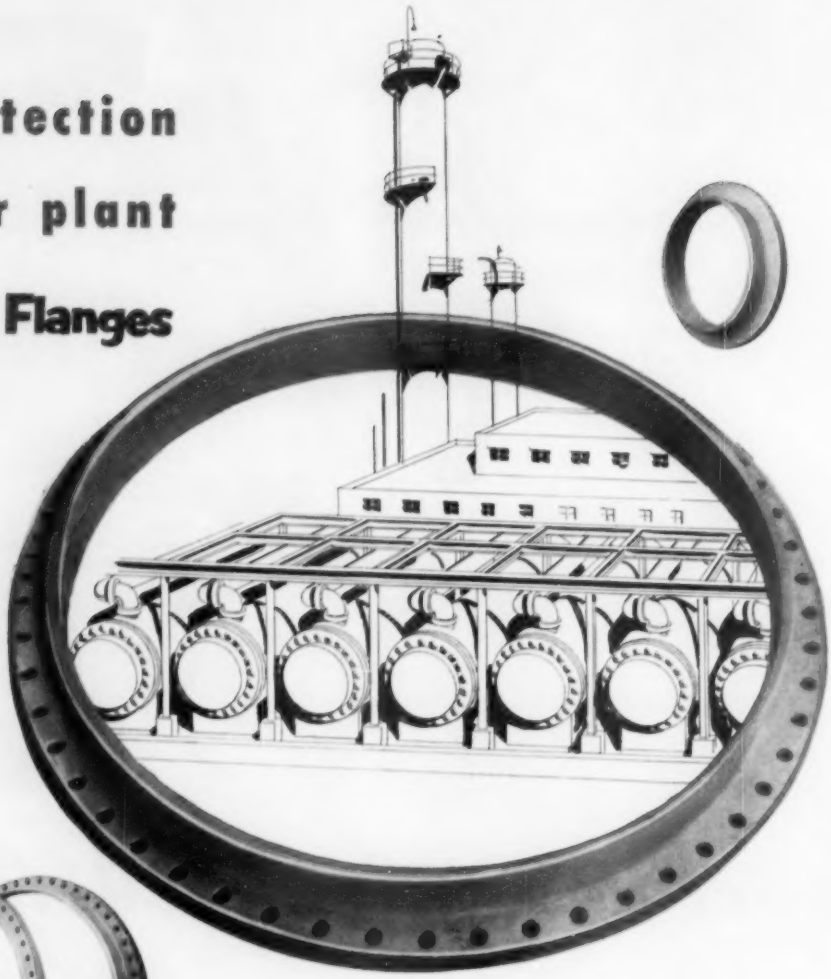
rings of protection around your plant

Railway Steel Flanges



For brake rims, gear blanks, sheave rings and circular sections (forged and rolled seamless) of many types, specify "Railway." To assure highest dependability in the finished products, we make the high quality steels in our own plant.

Install large-diameter Railway Steel flanges on your heat exchangers, pressure vessels and piping and you can be sure of maximum protection.

Made from carbon and alloy steels to all recognized American standards, Railway Steel flanges come in standard or special types, all sizes, ranging from 18 in. ID to 150 in. OD.

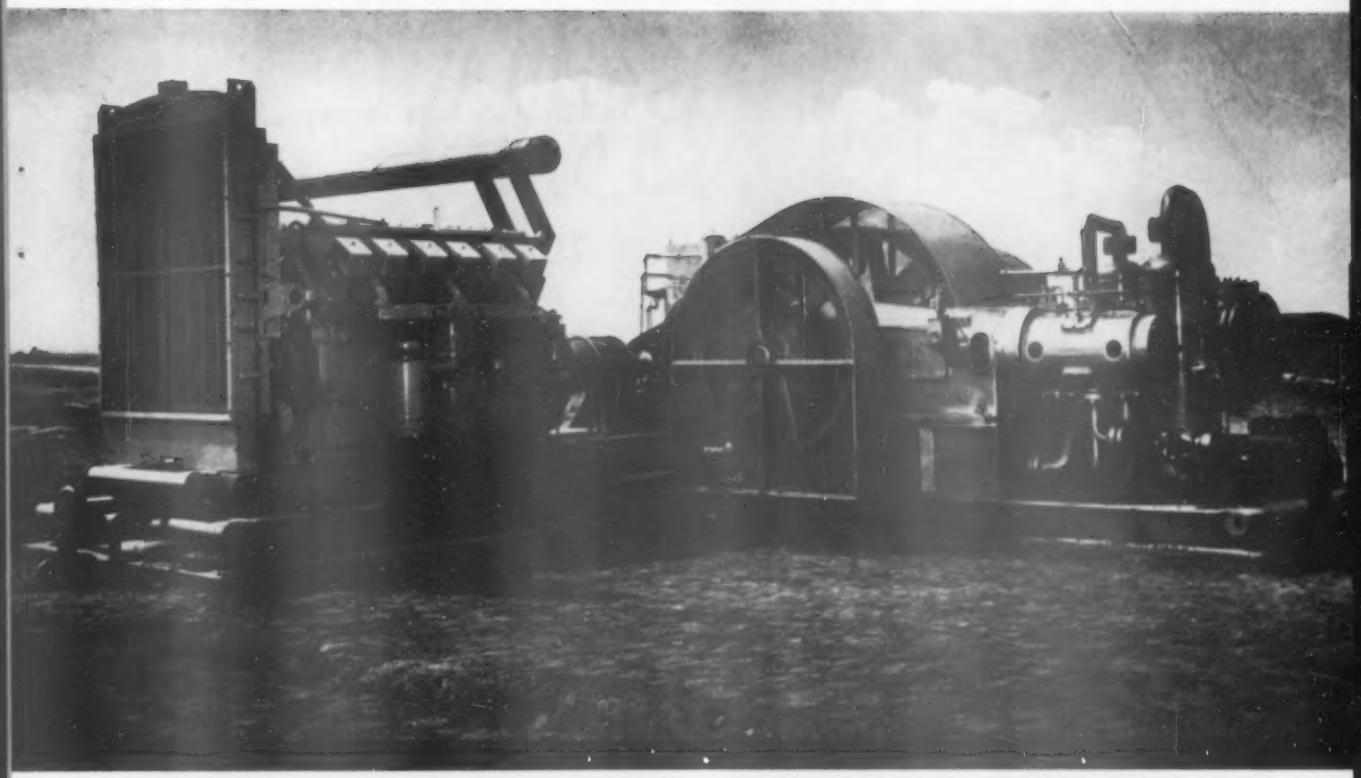
For full information, call our sales representative in Chicago, Cleveland, Houston, New York, Richmond, San Francisco, St. Louis, St. Paul or Tulsa.*

*Ardun Supply Company

Railway Steel Flanges

AMERICAN LOCOMOTIVE COMPANY

Rugged Performance



PROBLEM: To find a power supply that is extremely rugged and dependable for low cost, continuous operation. Reliability and service needed 24 hours a day seven days a week.

INSTALLATION: Power for a major oil company's packaged gas compressor near Sterling, Colorado.

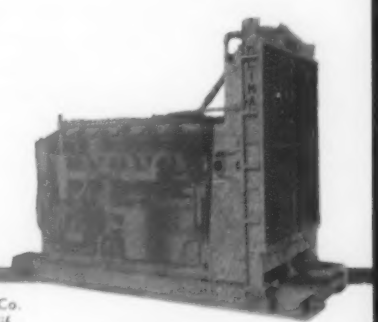
ANSWER: A Climax Blue Streak V-125, 12-cylinder natural gas engine.

This Climax engine operates at 1030 RPM, driving a Gardner Denver 13" compressor at 260 RPM, intake pressure 15#, first stage 130#, second stage 760#. Production is approximately 1,250,000 cubic feet of gas per day.

Do you have a power problem? There is a Climax distributor near you ready to help you solve it.

WHERE POWER IS YOUR PROBLEM, CLIMAX IS THE ANSWER.

climax BLUE STREAK ENGINES



CLIMAX ENGINE AND PUMP MFG. CO.

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& Marana, Ariz.

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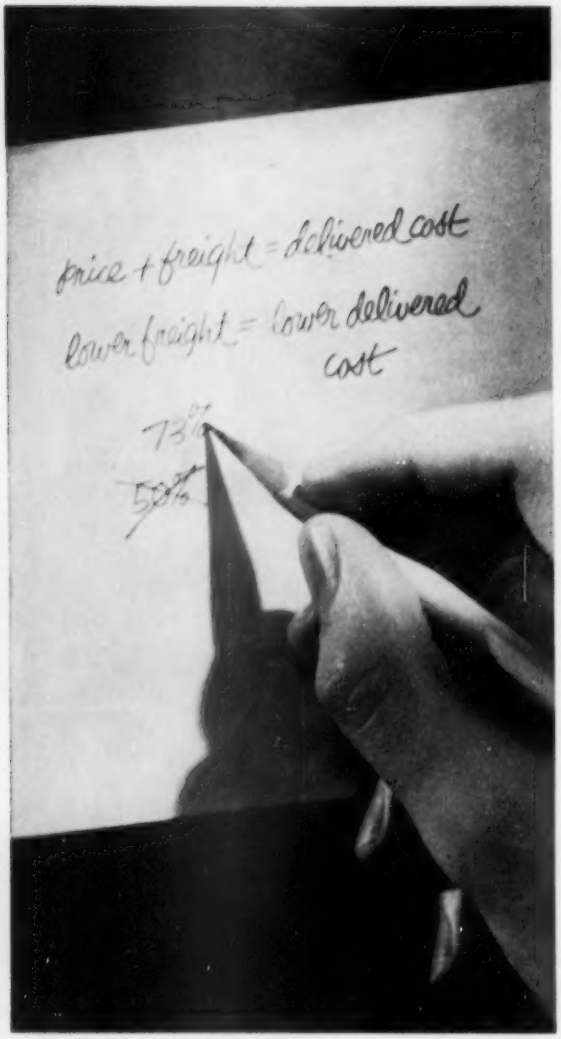


THE ECONOMIES OF 73% CAUSTIC SODA SOLUTION are no longer reserved for the largest users . . . lower shipping costs now make it the best form for you, too.

73% CAUSTIC SODA . . .

a little figuring may prove it your best buy!

FAST, DEPENDABLE DELIVERY of uniform 73% caustic solution is assured through use of Dow-owned tank cars. These 8,000- and 10,000-gallon cars are insulated, protectively lined, and fitted with nickel heating coils; unload from top or bottom by air pressure or pump. Frangible discs, protective plug cocks are two of the advanced safety features.

How long has it been since you have checked your caustic buying habits in the light of increasing cost factors? Higher freight rates are erasing the savings in 50% caustic solution for more and more users every day. Even users located near shipping points save money with 73%, since the higher price of even shorter distance hauls quickly wipes out the price difference between 73% and 50%.

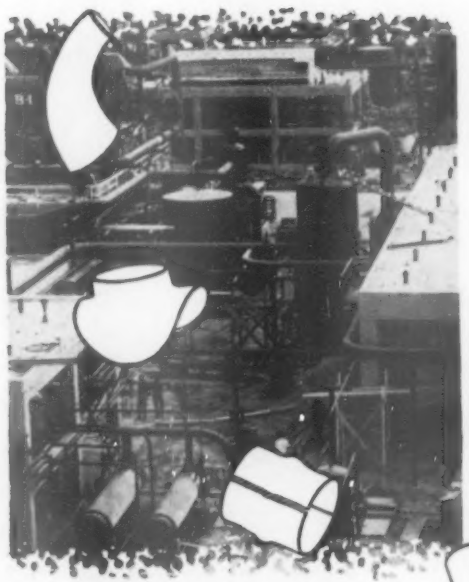
73% caustic must be diluted when received, but most caustic users dilute 50% solution, too. The cost of additional handling equipment for dilution, when fairly amortized, becomes a small item in comparison to your over-all cost reduction.

If you are still buying 50% caustic solution, discussion in your plant and consultation with our Alkali Technical Service is indicated. Perhaps the comprehensive Dow Caustic Soda Handbook can help you in preliminary discussion. Ask your Dow sales representative for your free copy or write to THE DOW CHEMICAL COMPANY, Dept. AL 901C-1, Midland, Michigan.

you can depend on DOW CHEMICALS DOW

3 IMPORTANT FACTS ABOUT MIDWEST WELDING FITTINGS

Check 'em



Midwest originated and developed the Long Tangent Elbow, the Reducing Elbow, Saddle, Sleeve, Shaped Nipple, and Lap Joint Stub End with large radius and heavy forged lap.

1 They are more ductile and have greater bursting strength than seamless pipe of comparable analysis.

2 They enable you to cut all pipe in exact accordance with designer's drawings. They are accurate and uniform.

3 The line is complete and varied. It gives you greater latitude in design and permits improvements and economies impossible to attain otherwise.

JONES & LAUGHLIN STEEL CORPORATION
SUPPLY DIVISION

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Gilbert & Barker Mfg. Co.
West Springfield, Mass.

Gentlemen:

Please send me brochure on the Gilbarco Electronic Tank Gauge.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

NOW YOU CAN MAINTAIN 100% GREATER ACCURACY

This coupon will bring you full information on a revolutionary

NEW ELECTRONIC TANK GAUGE

The new Gilbarco Electronic Tank Gauge, the result of years of laboratory research and field testing, actually *measures electronically*. No adjustments needed for varying specific gravities or viscosities. Can be installed *without* taking tank out of service. Liquid is measured with a degree of accuracy never before approached by any other method of gauging. And equally accurate readings can be made at remote points. Get full information on this revolutionary new gauge *today*.

Laboratory tank with Microballoon* layer on oil surface is shown at left, simulating field installation in which tank is emptied, then refilled.

Up, down. The surface of crude oil in storage tanks may drop one day, rise the next. But an installation of Microballoon* spheres —a half-inch floating blanket— stays in place, keeps the surface *fully* covered. It cuts evaporation loss 80-90 per cent. In an 88-foot diameter cone-roofed tank, that's a saving of 850 barrels a year!

These microscopic spheres of BAKELITE Phenolic Resin look like reddish-brown flour in bulk. Notice how they behave in these laboratory photographs. They seal the surface right up to the tank edge. Some cling to the tank sides as the level goes down. They're picked up again on the way up, and the tank sides are clear.

These spheres are hollow—they float to the surface in a matter of minutes when they're pumped in with the oil. Installation is fast. Since they're non-abrading, they won't harm pumping equipment or pipe lines.

Stop evaporation of costly volatiles now. Learn more about these spheres of BAKELITE Phenolic Resin by writing Dept. AH-64.

*Trade-mark of The Standard Oil Company (Ohio)

BAKELITE
TRADE MARK
PHENOLIC RESINS

TRADE MARK
BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
In Canada: Bakelite Company
Division of Union Carbide Canada Limited
Belleville, Ontario

Double Your Drying Capacity!

S/V Sovabeads Increase Dehydrator Efficiency Almost 100%

Yes, it's true—S/V *Sovabeads* will almost *double* the efficiency of your dehydrator units—maintain this efficiency at temperatures as high as 120°F.! And look at these other advantages:

S/V Sovabeads provide a longer desiccant bed life. They eliminate caking . . . reduce channeling, dusting and pressure drops. Reactivation is quick, easy and economical.

* * *

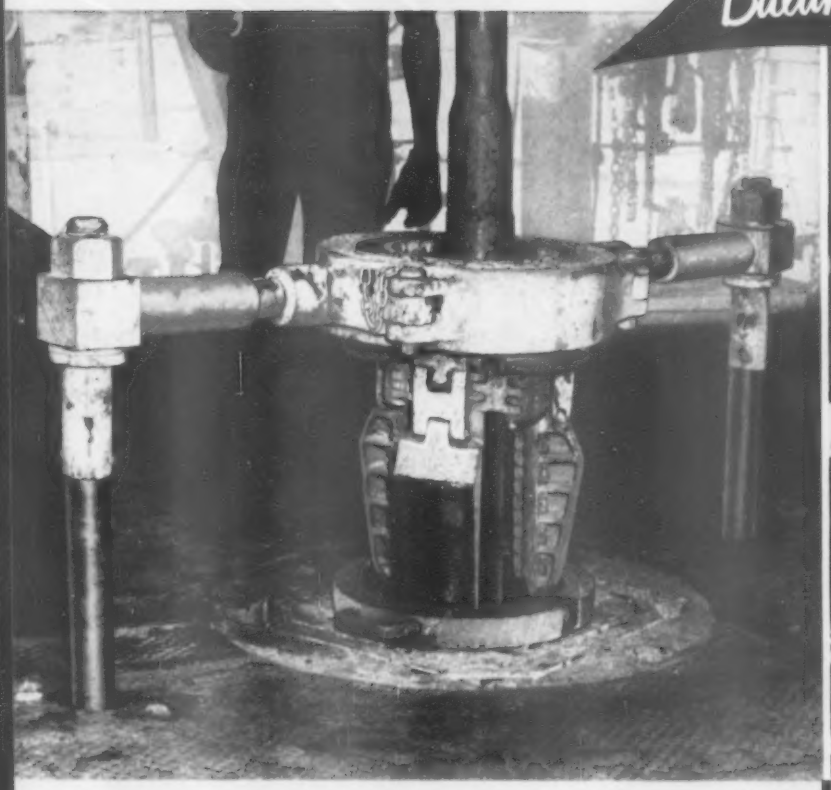
Why wait to improve *your* dehydration operations? Call your Socony-Vacuum Representative today for full information about S/V Sovabeads.

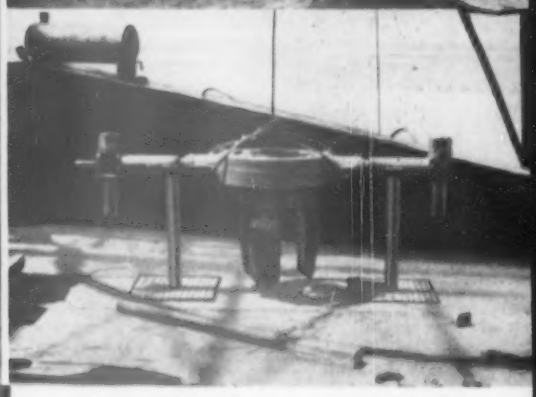
SOCONY-VACUUM
. . . process products

Process Products

SOCONY-VACUUM OIL CO., INC., 26 Broadway, New York 4, N. Y., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

WEB WILSON Balanced Power Slips*





(TOP) Showing slip assembly swung away from the rotary table on one of the supporting posts; the other has been retracted and covered with steel safety plate. (BOTTOM) Slip assembly has been lifted by the catline and set on the stand provided; both posts have been retracted and covered with steel safety plate.

"Balanced" for improved operation and longer life

Web Wilson Power Slips are "balanced" between two supporting posts mounted to opposite sides of the rotary table. There are no cantilever arms. Accurate alignment is assured—and all adjustments are made at the time of installation. Unique "free-floating" slip support does *not contact* the lifting ring during rotation. Thus there are no bearings or rollers to gall or wear.

Web Wilson Power Slips are quickly swung to one side on either of the supporting posts. It is not necessary to "strip" slip bowls or guide rings over the pipe. While drilling, the entire slip assembly can be lifted aside, and the supporting posts retracted, leaving the derrick floor *completely* clear.

Web Wilson Power Slips are easily installed, quickly dismantled or moved. Ruggedly built, with a minimum number of wearing parts, they require little maintenance.

Contact your Web Wilson sales agent or write today for additional information on time-saving, money-saving *Web Wilson* BALANCED *Power Slips.*

Balanced between two pistons
"Free Floating" slip support
Derrick floor clear while drilling
"Swing-Away" Gate
Rugged, Simple, Few Parts

*Formerly known as DECO Power Slips—Web Wilson will continue to sell interchangeable replacement parts.

WEB WILSON Oil Tools INC. FIELD PROVEN

LOS ANGELES, CALIFORNIA • DALLAS, TEXAS • NEW YORK, N. Y.

Mail address: Box 72096, Los Angeles 2, California

—to protect the quality of your gasoline

On-the-spot technical assistance helps you take full advantage of Tenamene

Inhibitor response is closely tied to many variables. These include the nature of the crude, the character of the stock fed to cracking units, operating conditions, equipment performance—even employee carelessness.

Proper and economical use of inhibitors depends on quick adjustments to these changing conditions. On-the-spot service often is a "must."

As the producer of the Tenamene additives, Eastman is ready with that service whenever and wherever you need it. Highly qualified men are less than 24 hours away, ready to make your refinery their headquarters whenever a problem arises.

For more information on Tenamene additives and the interested technical service that backs up their proper use, contact our local representative or write to Eastman Chemical Products, Inc., Kingsport, Tennessee—a subsidiary of Eastman Kodak Company.

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tenn.; New York—260 Madison Ave.; Framingham, Mass.—65 Concord St.; Cincinnati—Carew Tower; Cleveland—Terminal Tower Bldg.; Chicago—360 N. Michigan Ave.; St. Louis—Continental Bldg.; Houston—412 Main St. **West Coast: Wilson Meyer Co.;** San Francisco—333 Montgomery St.; Los Angeles—4800 District Blvd.; Portland—520 S. W. Sixth Ave.; Seattle—821 Second Ave.

Tenamene

EASTMAN GASOLINE ADDITIVES

A REFINERY ENGINEER REPORTS...

"We needed help planning steam and electric drives..."

"When the news got out, Don Dengler, Westinghouse Sales Engineer, called to tell me about Westinghouse experience with both types of drive."

HE SAID:

"Westinghouse conserves your time and cuts expenses, too, by providing only one contact for manufacturing, applying and servicing both types of drive.

"For example, can you talk with one of our local Westinghouse C. & A. engineers today? He will help you engineer both steam and electric drive installations.

"You've probably experienced installation and start-up problems," Dengler continued. "Westinghouse field service engineers work with you to smooth out those kinks. Get the refinery on stream in time.

"But Westinghouse field service does not stop there. Whenever you need maintenance or repair service, it takes only a phone call to your local Westinghouse office to get prompt, capable service."

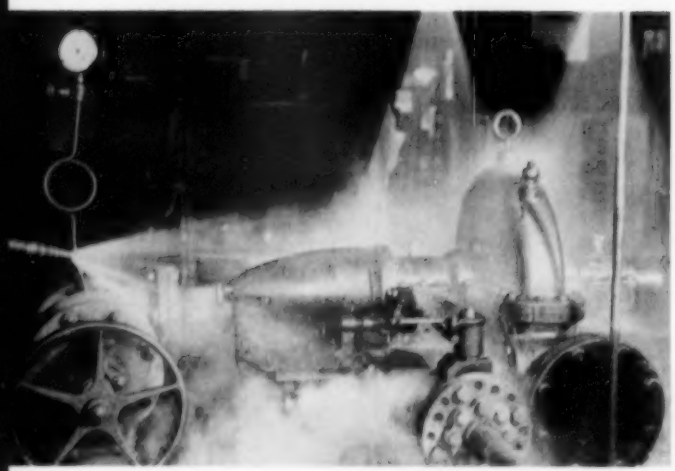
"OK, Dengler," I said. "Come on over. I want to see how you improve operating economy on refinery drives."

Next page, how Westinghouse improves turbine efficiency . . . →

YOU CAN BE **SURE**...IF IT'S Westinghouse

MEET DON DENGLER, AT THE DIAGRAM. HE TOLD US . . .

"Here's how Westinghouse turbine design matches your need for top drive performance"



Water-test periods running for hours and hours, with turbines operating and standing still, prove the effectiveness of bearing seals against water contamination of the lubricating oil.

Dust test sprays hard, abrasive particles on turbines operating at full speed. None of the abrasive enters the bearing housing; governor and overspeed-trip operate freely.

Flexibility to satisfy each application is the key to both the low operating cost and reliability of Westinghouse general-purpose turbines. Here's how it is achieved. Variations in governor types, rotor and staging design are standardized for Westinghouse turbines. Interchangeability of these standard components allows Westinghouse engineers to custom-assemble each turbine. This interchangeability, plus Westinghouse complete line of turbines, multi-stage to single-stage, brings greater accuracy in meeting your particular steam conditions, range of speed control, steam consumption and type of service.

Low inventory investment

Spare parts inventory for differing turbine installations can tie up important capital. Standardization of Westinghouse turbine parts is an answer. Gland seals, bearings, valve parts and governor components have a wide degree of interchangeability. A minimum inventory then backs up many different Westinghouse turbine applications.

Dependability from precision manufacturing

Over 50 years of expanding turbine developments adds valuable experience and dependability to Westinghouse design and manufacturing methods. Only those developments proved through years of actual service have been standardized. Skill and precision developed in manufacturing these components result in mechanical strength and construction which stand up longer under the toughest operating conditions.

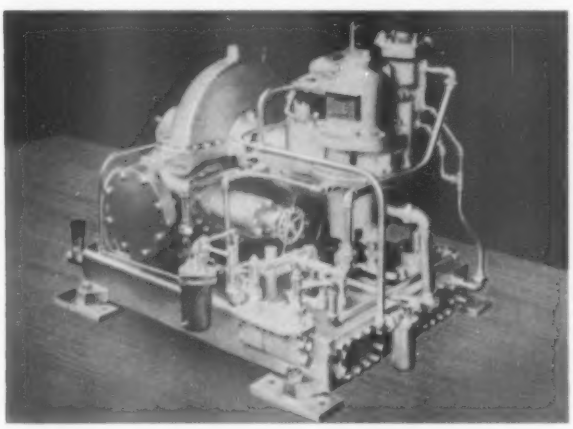
. . . Plus protection designed to "take it"

Watch Westinghouse turbines stand up under tough endurance testing and you have an answer to their ability to "take it". Positive protection results from corrosion-resisting alloys and ball and socket joints used on exposed governor mechanisms. There are no close-sliding fits to become corroded or jammed. Gland rings are mounted in corrosion-resisting inner casings. The rotor shaft, too, is protected at the gland zones by a generous, metal-sprayed coating of stainless steel.

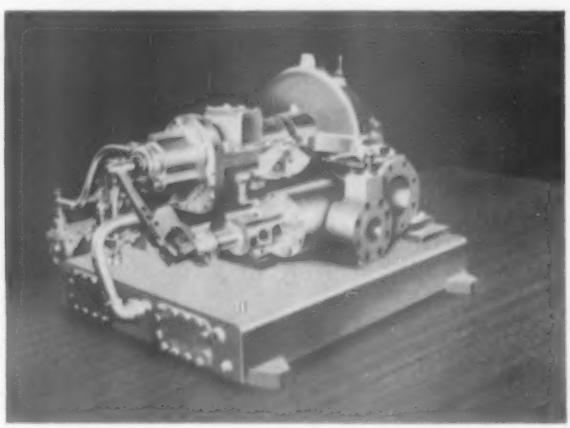
YOU CAN BE SURE...IF IT'S

Westinghouse

These standardized components for general-purpose, Type E turbines (5-1500 hp), are typical of the many parts that have a high degree of interchangeability between ratings. They allow Westinghouse to custom build each turbine for top operating economy. Mechanical governor shown gives accurate control and dual protection against overspeeding.

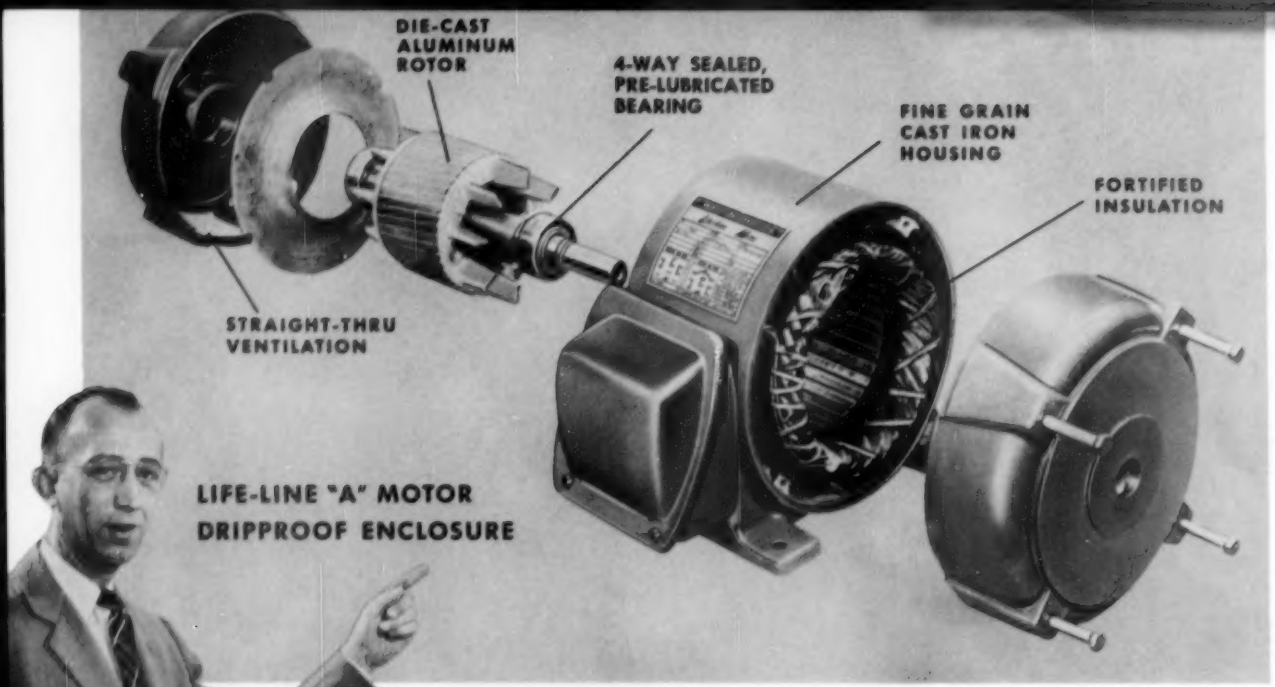


Here the Type E turbine rotor combines with the Westinghouse vertical oil relay governor to give the maximum in precise governing. The exclusive oil reservoir bedplate means quicker installation, simplified alignment, neater appearance.



This Type E turbine with the Westinghouse hydraulic orifice governor provides a wide speed range for drive applications such as fans and blowers. This is a direct-acting oil governor with hand speed changer for 3-1 speed adjustment.

Next page, an answer for electric drive flexibility . . .



PLANNING MOTOR DRIVES:

New Life-Line "A" protection and stamina offer greater application flexibility

Improvements in the new Life-Line® "A" motor line will answer your questions about adequate motor protection for refinery drives.

Compare enclosures for instance. In hazardous areas you naturally require the protection of the Life-Line "A" totally-enclosed, fan-cooled motor. And in those cases where you normally use a drip-proof motor the Life-Line "A" offers an improved enclosure of fine-grained cast iron. The straight-through ventilation design assures complete drip-proof protection *regardless of mounting position.*

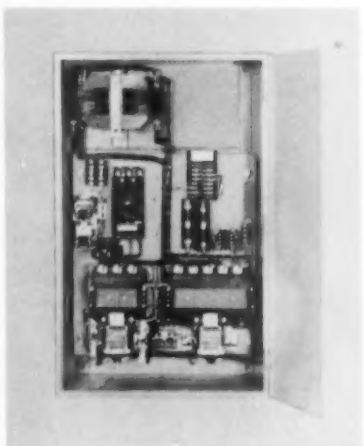
Improvements on the inside broaden the application flexibility of the drip-proof motor. Bondite stator insulation is fortified with silicone in homogeneous suspension with the insulation varnish affording unusual protection against chemical and water vapors plus improved stability for longer life. Four-way sealed, pre-lubricated Life-Line "A" bearings prevent dirt or moisture entering the bearing. They eliminate, too, the cost and time of greasing maintenance.

Talk further with Westinghouse application engineers about your horsepower requirements. They'll help you select from a complete line of Life-Line "A" and Westinghouse synchronous motors.

MP-3035

YOU CAN BE **SURE**... IF IT'S

Westinghouse



Add-a-part Panel for Westinghouse reduced-voltage starters provides maximum flexibility for process drive control. The panel is factory drilled with plenty of free-board area for on-the-spot mounting of additional timing, relaying or other control devices as required.

WHEN CAN WE START ON YOUR DRIVE PROBLEM?

Whether you're planning steam, electric or both types of drive, call your local Westinghouse sales engineer. He's ready with complete engineering and service facilities to give you immediate help. Ask him, too, for any of the following literature or write Westinghouse Electric Corporation, 3 Gateway Center, P.O. Box 868, Pittsburgh 30, Pa.

The New Life-Line "A" Motor	B-6154-A
Life-Line Gearmotors	B-5645
Speed Reducers	B-5646
Complete Industrial Control	B-6051
Life-Line Starter	B-5882
AB-I Circuit Breaker	B-5456
Synchronous Motors and Control	B-5300
Life-Line Motors (200-700 hp)	B-4731
Large Induction Motors	B-4739
Preventive Maintenance Booklet	B-5477
Type E Turbines	B-3896
Type M Turbines	B-3442

GREATEST ADVANCE IN TANK CARS IN 15 YEARS

acf built DURADOME *flued dome tank car*

DURADOME

TANK CAR PRODUCTION HIGHLIGHTS

PLANING . . .

Heavy gauge steel plate is cut to precision width with edges squared and beveled for fitting and welding—all in one automatic planing operation.

ROLLING . . .

Steel plate is then precision roll-formed by heavy duty rolls capable of handling large steel plates up to two inches thick.

FLUING . . .

A specially-built giant press forms the dome base by actually pressing and fluing it out of the heavy center section.

X-RAYING . . .

Automatic butt welds are used throughout. This results in stronger joints, and permits direct x-raying, guaranteeing sound welds.

Improved 4 ways

1 Flued Dome . . . dome base actually pressed out of heavy steel plate – eliminating fillet welds and dome shelf for more strength and corrosion resistance.

2 Pressure-type Construction . . . uses complete "ring-sections" or cylinders to build up the tank. That means heavier steel all the way around for greater durability.

3 All-welded Insulation Jacket (when required) . . . angles and bolts completely eliminated. Streamlined—more weatherproof—needs less maintenance.

4 Standardized Underframe . . . the same, all-welded underframe for tanks of all standard types and capacities. Provides flexibility; economical maintenance!

The DURADOME car is available for lease or sale through . . .

SHIPPERS CAR LINE SHPX

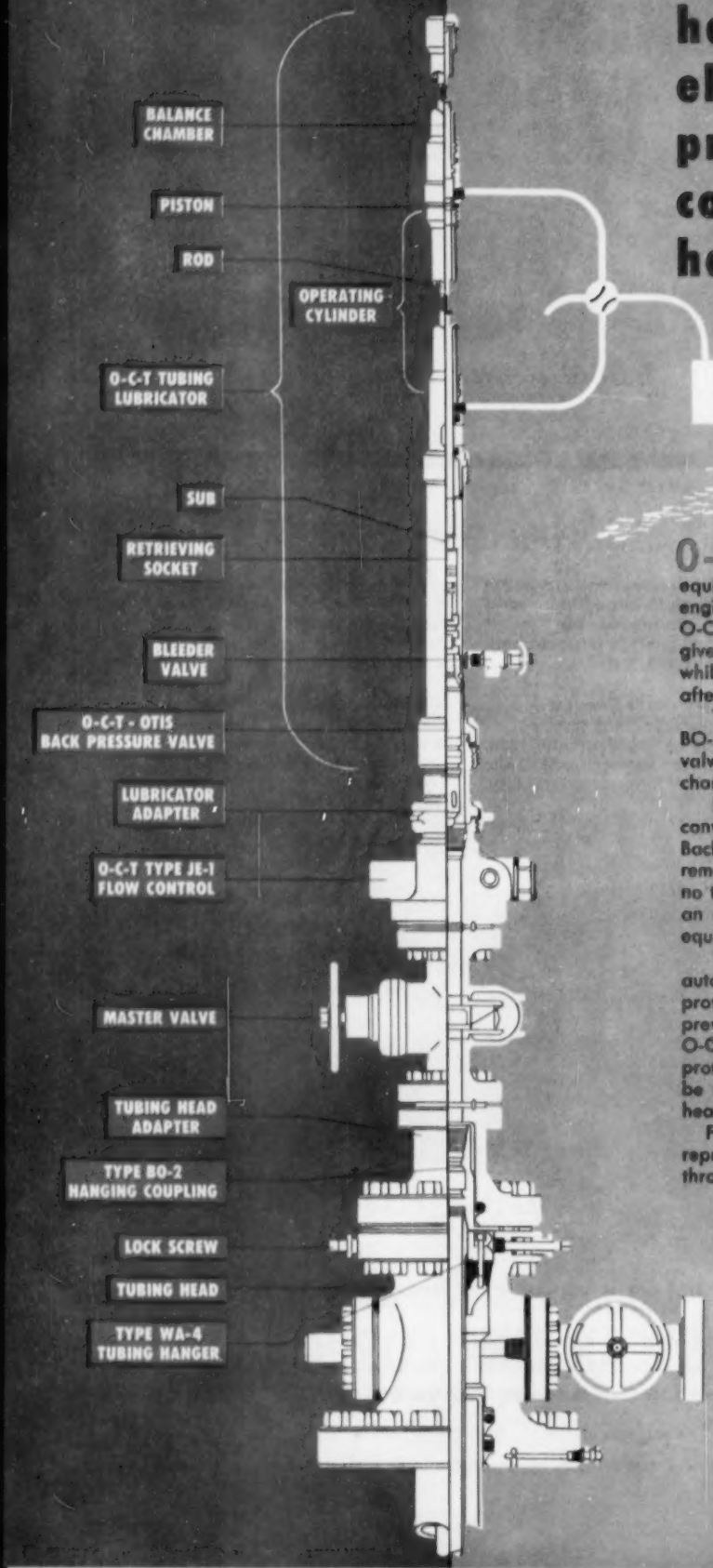
SHIPPERS' CAR LINE CORPORATION

30 Church Street, New York 7, N. Y.

A subsidiary of acf INDUSTRIES Incorporated

CHICAGO, ILL. • HOUSTON, TEX. • SAN FRANCISCO, CAL. • MILTON, PA. • EAST ST. LOUIS, ILL. • SMACKOVER, ARK. • TULSA, OKLA. • NORTH KANSAS CITY, MO.

How O·C·T·OTIS have combined to eliminate high pressure well completion hazards



O-C-T, the leader in high pressure oil field equipment, and Otis have combined their engineering skills to design and manufacture the O-C-T - Otis Back Pressure Valve. This valve gives you complete protection against blowouts while blowout preventers are being removed after tubing has been landed.

The O-C-T - Otis Back Pressure Valve and the BO-2 coupling are also adapted to run and set the valve into the coupling under pressure when changing a Christmas tree master valve.

Designed and built to do the job safely, conveniently and economically, the O-C-T - Otis Back Pressure Valve can be easily installed and removed under pressure, requires no rotation, has no threads to corrode with age, does not require an oversize tree and can be run with either O-C-T equipment or Otis wire line equipment.

The "C-19" Casing Head, the oil industry's first automatic, suspension and sealing hanger unit, provides casing seal and suspension before blowout preventers are removed. Combined with the O-C-T - Otis Back Pressure Valve you get double protection. O-C-T guarantees that the "C-19" can be set and nippled up faster than any other casing head, using the installation procedure you choose.

For details write or see your O-C-T representative. All O-C-T products are available through more than 700 supply stores.

O·C·T

OIL CENTER TOOL CO.

Export Representatives: Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

GULF SECURITY OIL

helps insure dependable performance of gas compressor units

Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

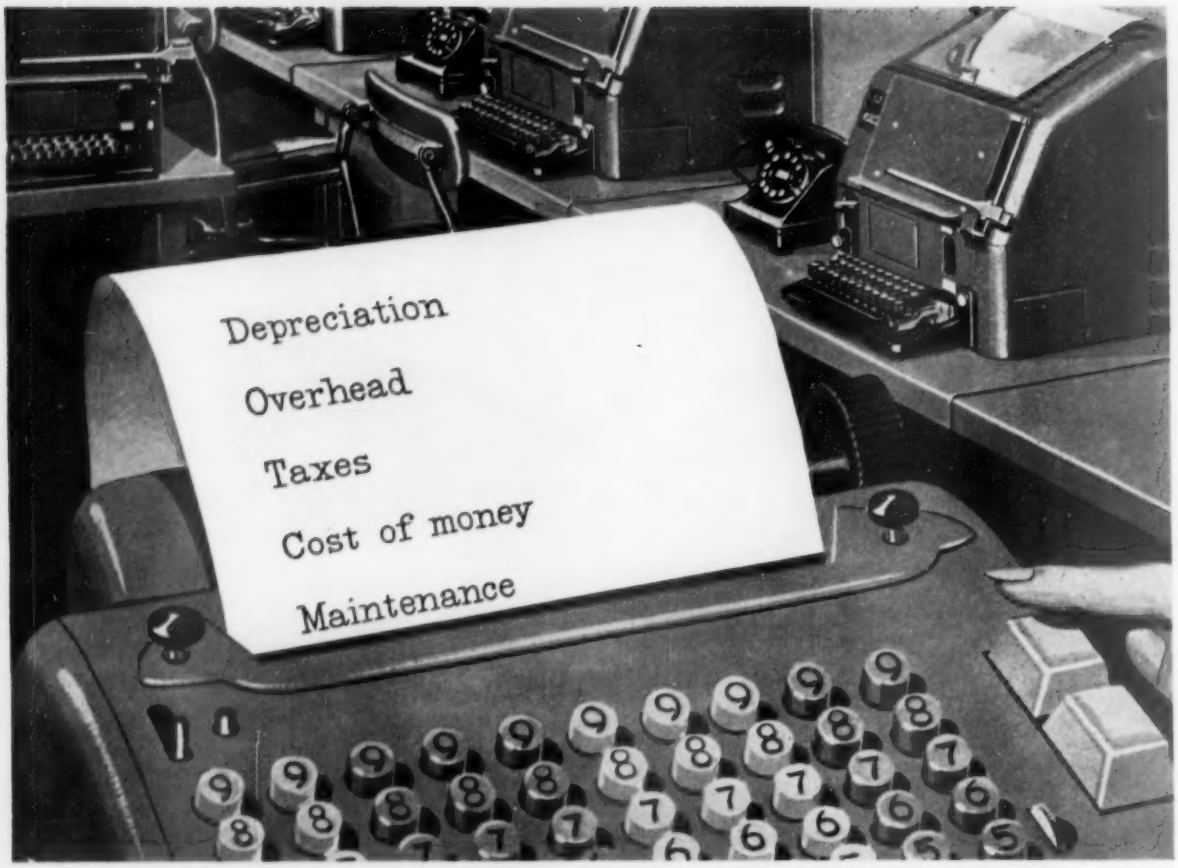
Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

Gulf Oil Corporation • Gulf Refining Company

1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

GULF INDUSTRIAL LUBRICATION



If you provide your own communications system . . .

HAVE YOU ADDED UP ALL THESE COSTS?

Owning and operating your communications system can be a costly experience, with many costs frequently overlooked. Depreciation, taxes, overhead, maintenance, loss of interest on capital all contribute to your total communication expense.

Bell System communications are low in cost. You pay only a fixed monthly charge for services tailored to your exact needs. No more, no less. Your capital is not tied up but left free for income-producing investments in *your* business.

Service has just begun when Bell System communications are installed. Maintenance, replacement, inventory, storage, extension and rearrangement of service are all handled rapidly and efficiently—no longer problems for you.

Let us show you how Bell System know-how and experience can be put to work to solve your communications problems. For a complete communications study, made without charge, call your local Bell Telephone representative today.

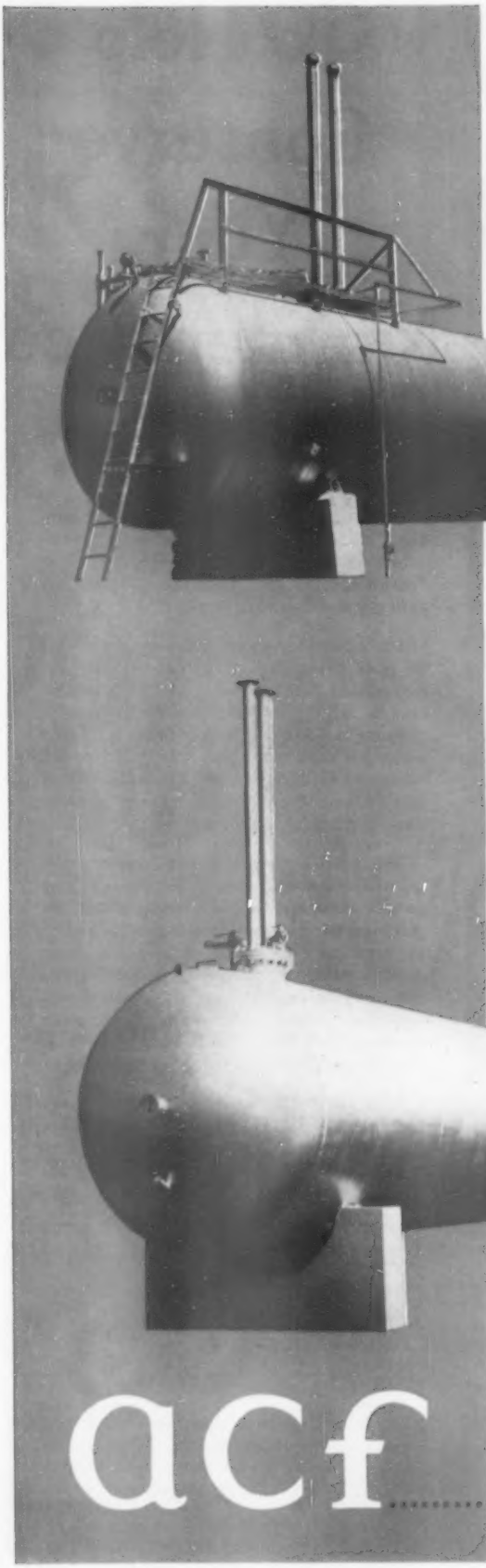
PRIVATE-LINE TELEPHONE

TELETYPEWRITER

MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM



which is the QUALITY TANK?

Both tanks look alike, but only the ACF-built tank has extra quality you can depend on! After fabrication, they are stress-relieved to eliminate stresses set up during forming and welding ... providing resistance to fatigue caused by temperature changes or pulsating loads. Every inch of welding seam is *radiographed* to assure freedom from slag inclusions, porosity and undercutting. Tank exteriors are steel grit-blasted to remove mill scale, resulting in a smooth surface for the red lead primer. Exacting shop inspections with final Hartford Steam Boiler Inspection is standard practice in accordance with ASME 1952 Code W-XR-SR.

ACF Tanks are available for propane, anhydrous ammonia, and other gases or liquids under pressure ... with man-ways for thorough inspections and cleanings ... with steel saddle supports for installation on flat foundations. For more specific information, write or call: Dept. E-12, ACF Industries, Incorporated, Industrial Products Division, 30 Church Street, New York 7, N. Y.

ask us

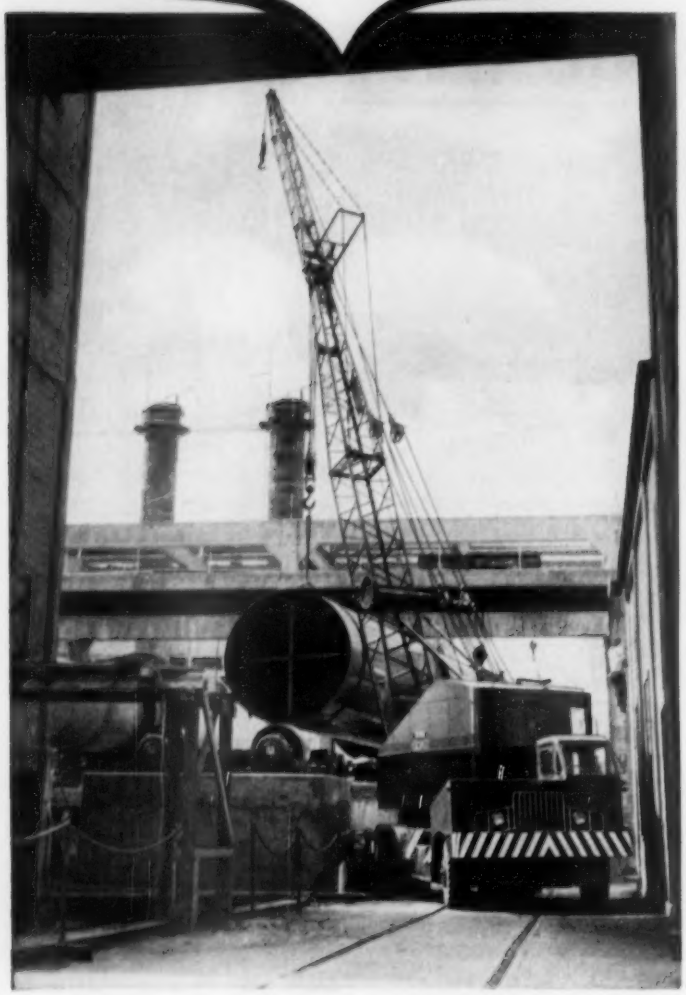
... about our new 30,000 gallon tank only 50 feet in length. Takes less installation space ... allows single-car rail shipment and cross-loading on export barges. Weight: only 67,000 lbs. ... costs far less to ship!

Quality you can trust

acf

STORAGE TANKS · TRUCK TANKS · SAFETY VALVES

In Position



To Help Conserve Your Maintenance Dollars

Sure, accurate boom control plus rubber-tired mobility — this combination of features, found at their best in Bucyrus-Erie Transit Cranes, can help you cut costs on refinery maintenance work.

Hoist and swing speeds are synchronized to give a high-speed cycle. A fully independent boom hoist, providing power control of raising and lowering, permits extreme accuracy in load handling. Extra boom sections can easily be added or removed to fit boom length to the individual job. Open-throat boom design permits easy rigging for multi-part lines.

The carrier mounting provides an all-welded base with maximum strength per pound of weight. Tandem rear axles are mounted on an equalizer beam to assure full traction over rough ground . . . have dual worm drive providing smooth application of power. Ten speeds forward and two reverse give a choice of speed-power combinations to fit a wide range of travel conditions.

There are a host of additional features that contribute to the outstanding performance of these fast-working, fast-moving cranes. See your nearby Bucyrus-Erie distributor for full details. 72E54

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

2 MODELS AVAILABLE

15-B

Maximum crane rating, 30,000 lbs.; maximum travel speed, 31 m.p.h.; convertible to ½-yd. shovel and drag-shovel, clamshell, and dragline.

22-B

Maximum crane rating, 50,000 lbs.; maximum travel speed, 31 m.p.h.; convertible to ¾-yd. shovel and drag-shovel, clamshell and dragline.

GEAR-TOOTH* DRIVE CLUTCHES

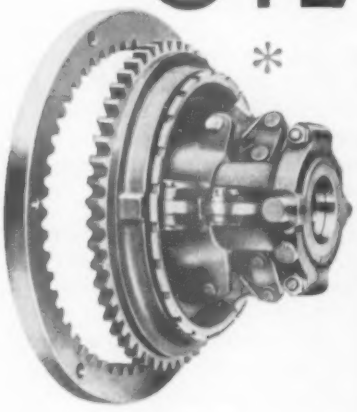
Make

ROCKFORD

POWER TAKE-OFFS

Best Suited For

OIL FIELD USE

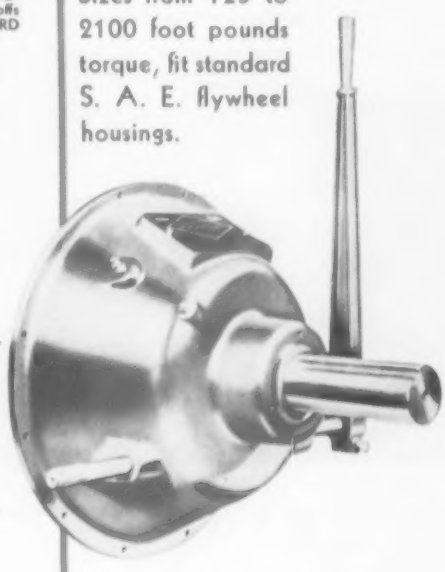


The *gear-tooth* drive type clutches in ROCKFORD POWER TAKE-OFFS minimize wear caused by starting and stopping shock loads — and the constant pounding of drilling and pumping rigs. The driving load is carried by teeth on the outside diameter of the facing member. The drive ring, with teeth that mesh with teeth in the facing member, is bolted to the flywheel of the engine. An adjustment ring provides for close, easy adjustment — without special tools — and without releasing or engaging separate locking devices. Adjustment and lubrication are made thru a convenient hand hole in the top of the dust-proof housing. Specify "ROCKFORD" and assure satisfactory power transmission control in your next drilling or pumping rig.

These ROCKFORD DISTRIBUTORS and DEALERS carry a stock of clutches, power take-offs and replacement parts to insure ROCKFORD clutch users prompt delivery and service.

Continental Sales & Service Company, Los Angeles, Calif.
Lightbourn Equipment Company, Dallas, Texas
Atlas Auto Parts & Grinding Co., Louisville, Kentucky
Wepco Equipment Company Cleveland, Ohio
Genuine Motor Parts, Pittsburg, Pa.
Auto Clutch & Parts Company, Chicago, Illinois
Auto Gear & Parts Company, Philadelphia, Pa.
General Machine Parts, New York, N. Y.
Highway & Industrial Equipment Co., Inc. Raleigh, N. Carolina
Blalock Machinery & Equipment Co. Atlanta, Georgia
M. D. Moody & Sons, Inc. Jacksonville, Florida
R. Angus (Alberta) Ltd., Edmonton, Alberta, Canada
Maase Equipment Co., Ltd. Montreal, Canada
Quebec City Gas & Diesel Engine Ltd. Quebec City, Canada
B-W-H Service Parts, Ltd., Merritton, Ontario, Canada
Cradle Equipment Company Utica, New York
Engine Service & Supply Company Odessa, Texas
National Supply Engine Corp. Portland, Ore. and Seattle, Wash.

Sizes from 125 to 2100 foot pounds torque, fit standard S. A. E. flywheel housings.



Send for This Handy Bulletin

Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

ROCKFORD CLUTCH DIVISION

Borg-Warner • 1305 Eighteenth Ave., Rockford, Illinois

Fast Welding

Field welding 12¾" Electric Resistance Weld Line Pipe near Bartlesville, Okla.

Easy Bending

Bends are easy to make in the field—as shown in this line of 10¾" Electric Resistance Weld Pipe near Cushing, Oklahoma.

Straight Lengths

26" Republic Electric Fusion Weld Line Pipe being laid near Petersburg, Ohio.

SAVE

PIPE LINE INSTALLATION TIME

It's easy to do—with pipe that *comes in straight lengths, bends easily, welds rapidly.* And pipeliners know that Republic Electric Resistance Weld and Electric Fusion Weld Line Pipe do all three. That's why so many thousands of miles of both are being used all over the world.

Line pipe that is dependably straight speeds up production. Delays are avoided. You get constant circumference, too. That means no difficulty lining up field joints. Result: the entire circumference is welded at top speed. And because uniform wall thickness assures even distribution of metal all around the pipe, a good weld is assured.

High ductility permits smooth, uniform bends to be easily made in the field. And you can build high pressure lines with Republic Line Pipe due to its uniform high yield strength.

Remember: to save time and money, specify Republic Line Pipe. We make three types: Electric Resistance Weld from 2⅜" through 16" O.D.; Electric Fusion Weld from 24" through 30" O.D.; also Continuous Butt Weld Pipe for gathering and distribution lines from ⅛" through 4" nominal. Write for more facts.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

REPUBLIC STEEL

REPUBLIC LINE PIPE

ELECTRIC RESISTANCE WELD • ELECTRIC FUSION WELD
CONTINUOUS BUTT WELD

Other Republic Products include Casing and Tubing — Steel and Plastic Pipe — Studs, Bolts and Nuts — Heat Exchanger Tubes — Steel Buildings

Ansul

is the only dry chemical fire extinguisher backed by a five year warranty!

Here is proof of Ansul's superiority . . . *a five year equipment warranty*, the only one of its kind in the fire control industry.

For the buyer of fire equipment this important warranty means many *extra* years of trouble-free protection plus freedom from costly and frequent maintenance checks and repairs.

The special design and construction features that make this warranty possible provide not only dependable protection but also *fast, effective* fire control. Ansul's *weather-tight* construction keeps out moisture and resists corrosion. *Patented nozzles* deliver the right kind of stream for your fire protection problem. The *sealed pressure cartridge* puts Ansul's "Plus Fifty" dry chemical to work immediately—no delay or lag. And finally *rugged construction* makes it possible for Ansul equipment to give peak performance under the toughest operating conditions.

HERE IS THE BIG TRAINING AND SERVICE PLUS OFFERED ONLY BY ANSUL!
Available without cost to all Ansul users.

Training for your personnel at your plant by Ansul specialists.

Customer training school at Marinette for your key safety personnel.

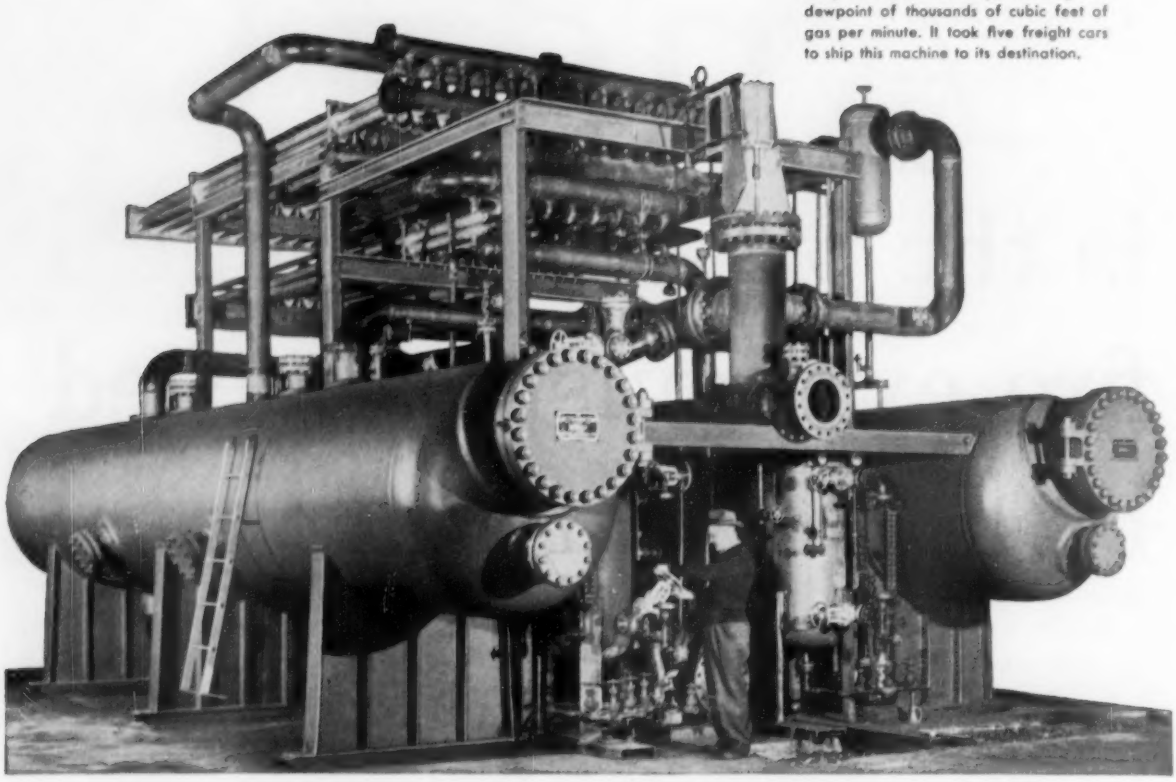
Visual aids on fire control for your safety meetings and other training.

In-plant survey to scientifically determine your fire protection needs.

Call the Ansul Man!

ANSUL

Get in touch with your local Ansul man through the "yellow pages" or write ANSUL CHEMICAL COMPANY, Fire Equipment Div., Dept. F-93, Marinette, Wisconsin.



This giant Lectrodryer operates continuously and automatically, lowering the dewpoint of thousands of cubic feet of gas per minute. It took five freight cars to ship this machine to its destination.

The Consulting Engineer Said, "Put A Dryer Here..."

So we did!

This huge DRYing machine grew out of that notation on a plan and a listing of requirements. That's all Lectrodryer* engineers need to design and build an efficient DRYer that will reduce dewpoints to a harmless level.

Perhaps your need for DRYness is just as acute, but you require less volume... higher or lower pressure. There probably is a Lectrodryer already designed to fit your particular process. Lectrodryers will reduce dewpoints to as low as −100°F. They can lower humidity to a low 10%. Certain types will handle pressures up to 6000 psi.

Write for *Because Moisture Isn't Pink*, a booklet describing how industry is using Lectrodryers of all types. Pittsburgh Lectrodryer Corporation, 325 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

*REGISTERED TRADEMARK U. S. PAT. OFF.

CEC increases the scope of

industrial mass spectrometry

through two great instruments for process monitoring and control

Consolidated's Model 21-610 mass-spectrometer and its companion, the new Model 21-620, far excel all other instruments of comparable price in performance capabilities and reliability in industrial environment. The extreme sensitivity of the 21-610—accurate to a few parts per million—qualify it for highly critical purity studies as well as process monitoring and control applications. Fitted with an accessory hand-held probe, either model serves as a leak detector for any gas within its mass-range. The 21-620's resolving power up to mass 150 further extends the applicability of an industrial mass-spectrometer to research laboratories and medical centers, as well as to plants of chemical, petro-chemical, petroleum and gas industries. Nearly identical in appearance, the 21-610 features the Diatron ion analyzer and the 21-620, a new cycloidal focusing analyzer.

21-620 Except for slightly less sensitivity, the 21-620 has all the capabilities of the 21-610 plus many others. Where the task is to analyze "heavy" gases or liquids, either in plant locations or in the laboratory, the 21-620 process monitor mass-spectrometer is the ideal control instrument.

21-610 The 21-610 is completely self-contained, needing only 110 volts and a small quantity of cooling water for operation. Moderately priced, easily movable, and economical to operate, the 21-610 is industry's ideal instrument for chemical research, process control and leak detection.

CEC Service Engineers quick change of ion analyzers (right) adds flexibility to Consolidated's two process monitoring mass-spectrometers. A cycloidal focusing analyzer assembly of the 21-620 type is being mounted in the vacuum rack in place of the Diatron analyzer of the 21-610.

The basic instrument can be augmented by many available accessories, thus broadening its application scope. At the far right, are a gas or light-liquid sample inlet system and chart recorder.

Investigate the application of industrial mass-spectrometry to your business. For full details about CEC's two companion process monitoring mass-spectrometers, send for Bulletin CEC 1824A-X8.

Consolidated Engineering

CORPORATION

300 North Sierra Madre Villa, Pasadena 15, California

Sales and Service through **CEC INSTRUMENTS, INC.,** *a subsidiary with offices in:*
Albuquerque, Atlanta, Buffalo, Chicago, Dallas, Detroit, New York, Pasadena, Philadelphia, Seattle, Washington, D. C.

Blanketed Base Pans and Automatic Sentries Push Service Dates Apart

Service dates skip months instead of days where operators have Minneapolis-Moline long-run oil field engines. MM exclusive water-jacket base pan with large built-in filters keep engine and lube oil at constant temperature under any load or weather condition.

Automatic control of crankcase temperature prevents sludging and enables more effective filtering. The high efficiency of MM exclusive vacuum crankcase ventilation is obtained by blanketing the base pan with engine water. This holds crankcase vapor above the dew point so that (instead of condensing and forming sludge) it is withdrawn.

Added advantages of MM long-run design are extra large permanently lubricated bearings, sealed pressure cooling with water by-pass and thermostat control, built-in oil-flow controllers and automatic sentries —safety cutouts that prevent damage in case of low oil pressure or excessive water temperature.

For complete facts and specifications on lowest cost and most dependable power in the oil fields phone

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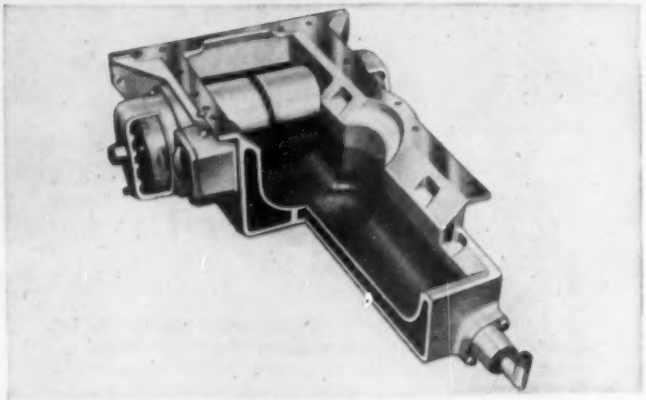
Twenty Years of Oil Field Engine Application at Your Service

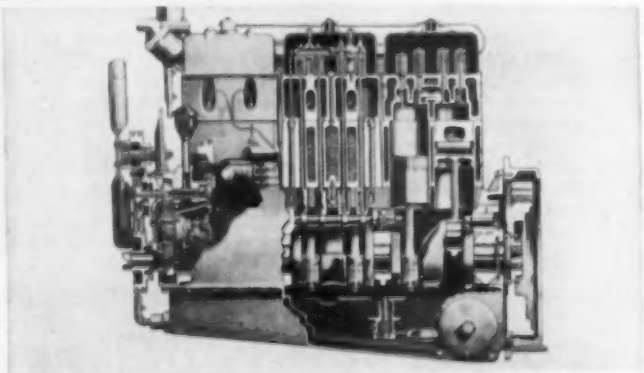
INDUSTRIAL DIVISION

MINNEAPOLIS-MOLINE

MINNEAPOLIS 1, MINNESOTA



Water-jacketed heat exchanger base pans with large built-in filters provide automatic thermostatic control of lube oil temperature. Oil flow controller maintains constant oil level from reservoir supply. Heavy flange on flywheel end provides 360° rigidity to crankshaft alignment.



Engine cross-section shows how MM cooling maintains the entire engine at a constant temperature. Variation maximum is 4° to 5°. Automatic thermostatic control and by-pass system act as heater or cooler—engine runs at constant temperature under all operating conditions.

Here's GROVE Air Dome Dependability—*in well head protection*

...the GROVE Model 390 Automatic Shut-Off Systems

For dependable protection against dangerous well head conditions, install the Grove Model 390 Systems, designed for automatic shut-off in the event of line breakage, freezing or failure of other equipment. Universal in pressure range, any Model 390 System can be preset for overpressure or underpressure shut-off from 50 to 6000 p.s.i., and will operate as often as needed—ten times a day or once in a lifetime. Resetting can be manual or automatic; adjustment changes or testing require no main line bypass and are quickly and easily accomplished without removal from the line.

Both main and pilot valves contain large powerful diaphragms, and utilize the patented Grove Air Dome principle. There are no springs to set—the Grove Air Loading feature makes setting as easy as reading a gauge. Elimination of pistons and piston packing gives a dead tight seal with no chance of corrosion or sticking.

The outstanding qualities of the Grove Air Dome design have been proved in over a quarter-million installations. Now, for Well Head Protection, Grove offers the safest, surest shut-off available. To prevent waste—to safeguard expensive equipment—and to cut down maintenance, contact the nearest Grove office today . . . ask for full details on the Model 390 Well Head Protection Systems.

GROVE VALVE and REGULATOR COMPANY • 65th & Hollis Sts., Oakland 8, Calif.
HOUSTON 4—1901 Calumet St. • **LOS ANGELES 6**—1930 W. Olympia Blvd. • **NEW YORK 17**—415 Lexington Ave.
ODESSA, TEXAS TULSA, OKLAHOMA LAFAYETTE, LA. DENVER, COLO.

GROVE GROVE "PUTS PRESSURE TO WORK" MODEL 390 WELL HEAD PROTECTION SYSTEMS

...it's *Stringtime* in the Rockies

A sure sign that the oil hunters are at work is the seismic string — the "jugs" and cable used in recording shock waves from charges the seismic crews fire as they search for spots where oil might be found. The strings are busy in the Rockies these days and among the busiest are those from Shell Oil Company. The work of the seismic crews is one of the many costly operations undertaken in the continuous exploration for new oil fields — to serve a nation that moves on petroleum.

SHELL

SHELL OIL COMPANY

Save the beans - throw away the holes

● Illustrated — Unibolt Flow Manifold for single wing tree, consisting of Unibolt Tee, Wing Valve, and Positive Choke Body.

LOW COST

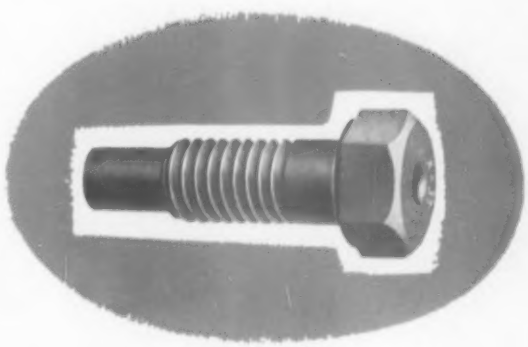
UNIBOLT

X-BEAN INSERTS MAKE POSITIVE CHOKES AS GOOD AS NEW

You don't have to change beans. Change inserts. You accomplish the same results but for a fraction of the cost. Unibolt Master Beans, for Unibolt Choke Bodies and Unibolt Cage Nipples, are drilled to receive a small replaceable insert. So, when the insert wears out just replace it . . . save the bean.

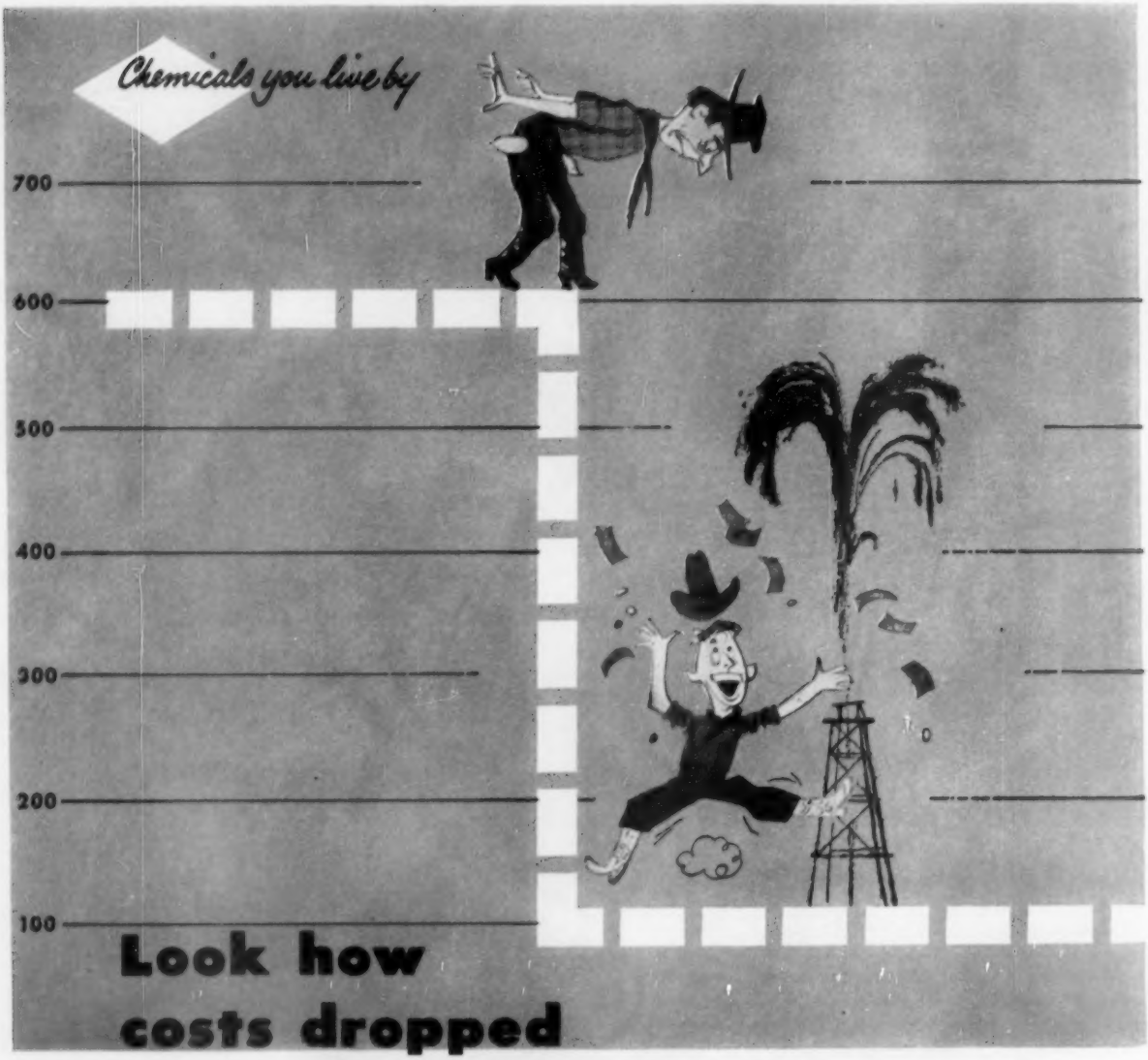
These little inserts are available in **42 "X" sizes under 14/64ths.** That means that they are drilled in increments of 5% and 10% of well flow rather than in increments of 1/64th inch. Consequently, the flow of fluid or gas can be positively controlled with a degree of accuracy never before attained. If, for example, a well produces 10 bbls. through a 1/64-inch choke, to increase the choke to the next largest fractionally drilled size, 2/64-inch, would increase the production to approximately 40 bbls. On the other hand, a well that produces 10 bbls. through a size X-35 UNiBOLT X-Bean would produce only 10½ bbls. through the next largest size X-Bean, X-35.5; 11 bbls. through an X-36, and so on.

This accurate control of production is a safeguard against the harmful effect of periodically pulling a well too hard in order to make its allowable.



THORNHILL CRAVER CO.

P. O. BOX 1184 HOUSTON, TEXAS



Look how costs dropped when Diamond Chromates were added!

You have had to ante up many times for the staggering costs of corrosion. Do you know that in many cases these costs can be materially reduced? Here are some actual figures: One producing well was showing maintenance costs averaging $600 per month. Then DIAMOND Chromates were introduced.

Maintenance costs dropped to an average of $100 per month! A saving of $500 a month! Think how much you would save if all your losses from corrosion were cut in the same proportion.

You can easily get more facts and figures and the benefit of practical experience and technical know-how as well. Just call your DIAMOND representative. He will be glad to tell you of the many other cost and time saving applications for DIAMOND chemicals in the petroleum industry.

Call your nearby DIAMOND Sales Office or write DIAMOND ALKALI CO., 300 Union Commerce Building, Cleveland 14, Ohio.

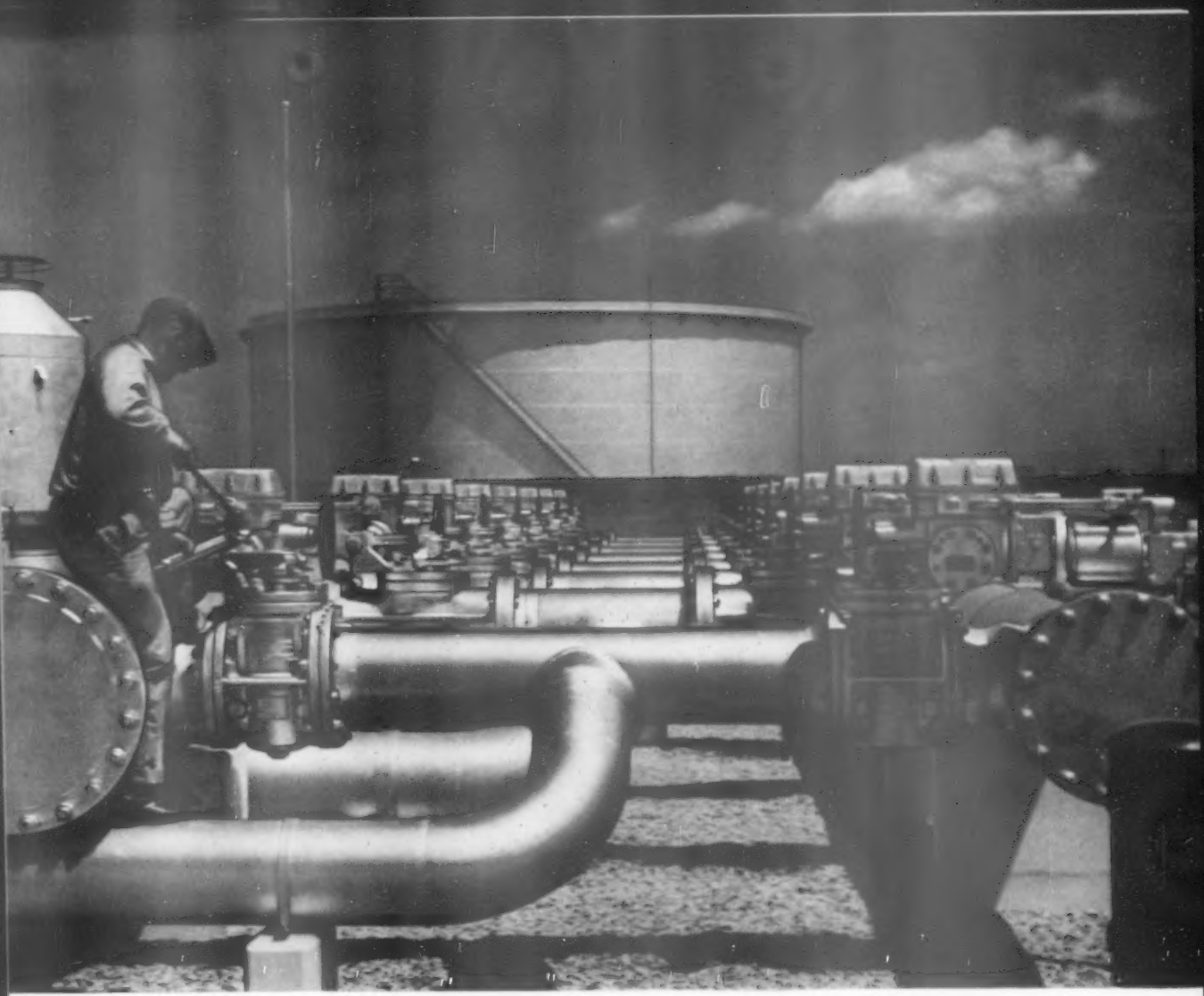
DIAMOND ALKALI COMPANY
CLEVELAND 14, OHIO

DIAMOND SALES OFFICES:

New York,
Philadelphia,
Pittsburgh,
Cleveland,
Chicago,
Cincinnati,
St. Louis,
Memphis,
Houston.

Diamond Chemicals for the Oil Industry

DIAMOND ALKALI CHEMICALS ®



PICTURE OF MAINTENANCE COSTS BEING LOWERED

Every plant that keeps complete records comes to the same conclusion—periodic valve lubrication *saves* money; it's valve failure and replacement that sends maintenance costs skyward.

That is the basic fact behind the Rockwell-Nordstrom valve design, for the internal lubrication system eliminates most reasons for valve failure—Rockwell-Nordstrom lubricant *prevents* galling, jamming, abrasive wear, and seepage.

Systematic lubrication of Rockwell-Nordstrom valves with the right Rockwell-Nordstrom lubricants inevitably leads to lower operating costs. There is no substitute for Rockwell experience—use it to save money on valves. *Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.*

THREE WAYS
THE NORDSTROM LUBRICANT WORKS

1. Lubricant surrounds each valve port with a vapor tight pressurized seal. **Nordstrom valves stay tight.**
2. Lubricant acts as hydraulic jack—a fast quarter-turn to open or close. **Nordstrom valves operate quickly.**
3. Lubricant coats the plug for sliding action—no wear-producing wedging. **Nordstrom valves operate easily.**

Rockwell Built

NORDSTROM VALVES

Lubricant Sealed for Positive Shut-Off

WHICH PRODUCT IS EASIEST TO MAKE?

Every manufacturing process has its own special problems. There's no fair way to compare the difficulties of processing paint and paper, or of synthetic rubber and synthetic textiles, for instance.

In every process industry, too, there are special problems of flow control, and no matter what claims you read, there is no such thing as an all-purpose valve.

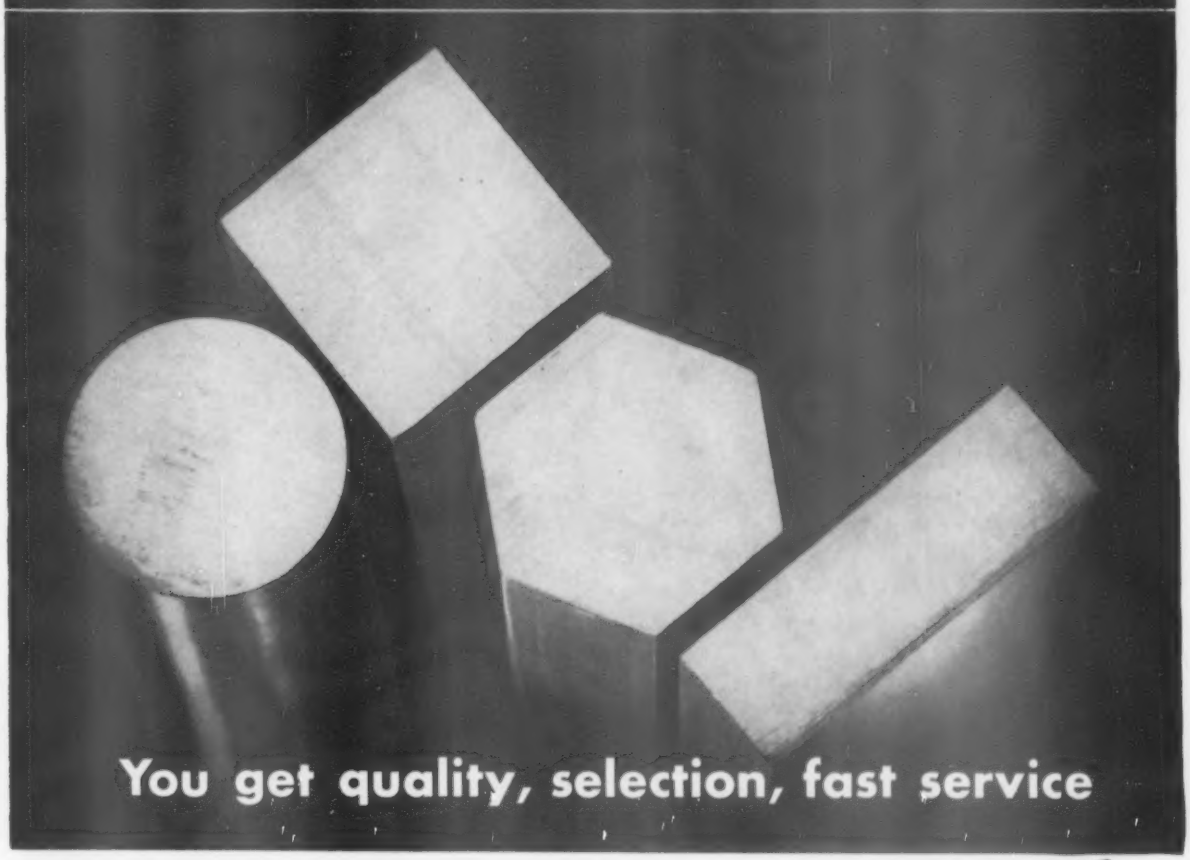
Undoubtedly, Rockwell-Nordstrom valves approach that point more closely than others because they use the Nordstrom-originated principle of internal lubrication. Rockwell-Nordstrom lubricants seal tightly in gas, liquid or slurry service, and at the same time make operation easy, and eliminate galling or seizing.

Further, Rockwell-Nordstrom makes the widest range of sizes, pressure classes, metals and lubricants, so that for any process, you're wise to check first with *Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.*

Nordstrom Valves

Another Quality ROCKWELL Product

WHY IT PAYS TO BUY COLD FINISHED BARS FROM US



YOU will save money buying your cold finished bars from U.S. Steel Supply. We carry complete stocks of all the shapes and sizes that are in common demand. All are manufactured from the world's leading quality steel—United States Steel. And we will work closely with you to select exactly the right quality for your requirements—and the right quality is *not* always the most expensive.

You needn't tie up money and space in large inventories of cold finished bars . . . we can quickly supply whatever you need. Call us for: cold finished rounds, squares, hexagons, flats and precision shafting in all grades; cold finished screw stock, Bessemer rounds, "MX" high speed screw stock.

TRIPLE SECURITY

What you want
When you want it
At the right price

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208 So. La Salle St., Chicago 4, Ill.

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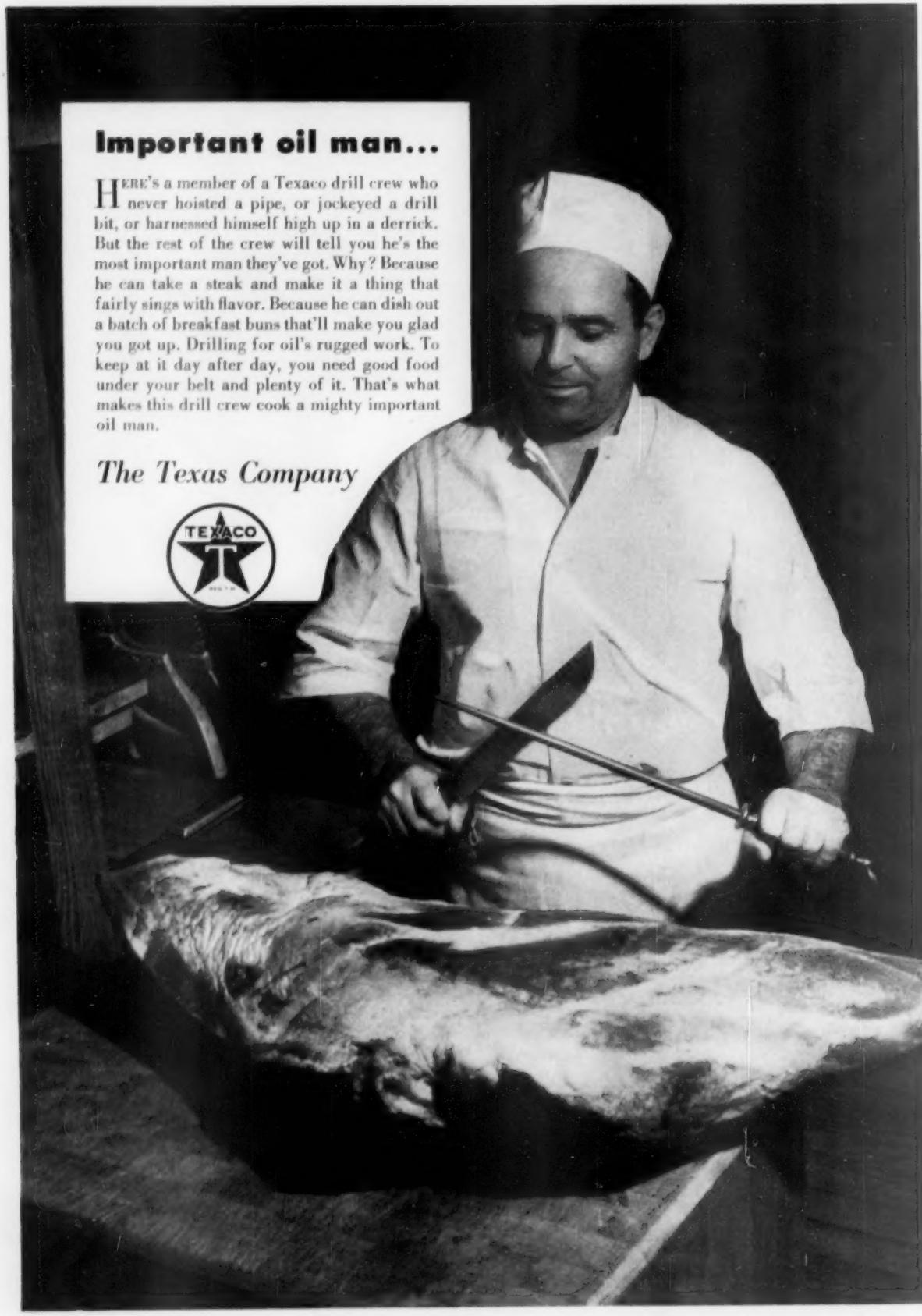
UNITED STATES STEEL

UNITED STATES STEEL


Important oil man...
HERE's a member of a Texaco drill crew who never hoisted a pipe, or jockeyed a drill bit, or harnessed himself high up in a derrick. But the rest of the crew will tell you he's the most important man they've got. Why? Because he can take a steak and make it a thing that fairly sings with flavor. Because he can dish out a batch of breakfast buns that'll make you glad you got up. Drilling for oil's rugged work. To keep at it day after day, you need good food under your belt and plenty of it. That's what makes this drill crew cook a mighty important oil man.
The Texas Company
TEXACO

"Trioflex is just what we need"

says Mayhew Machine & Supply Co.,
leading manufacturer of portable drilling rigs.

"We chose Trioflex Slim Hole Rotary Hose because it combines unusual strength with the light weight so necessary to portable units for work overs and geophysical exploration. Its flexibility makes it easy to handle."

Trioflex is dependable. Look at these outstanding features:

- Synthetic rubber tube resists oil and abrasion
- Braided steel wire reinforcement adds strength and flexibility
- Tough, specially compounded cover provides long life
- Pressed-on couplings anchored securely for life of hose
- Every length pre-tested to 2000 psi.

Furnished in these sizes:
2"—with 2" male couplings, API threads
2½"—with 2½" male couplings, API threads
3"—with 3" male couplings, API threads

Thermoid
Industrial Rubber Products
Quality Value Service

Get Trioflex from your supply house, or the nearest Thermoid Warehouse.

Mid-continent Office and Warehouse: Houston, Texas

California Office and Warehouse: Los Angeles

Thermoid

Powerflex Rotary Hose • Trioflex Slim-Hole Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • F.H.P. and Multiple V-Belts • Oil Country Flat Belting

Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All Types of Hose • Molded Specialties • Brake Blocks

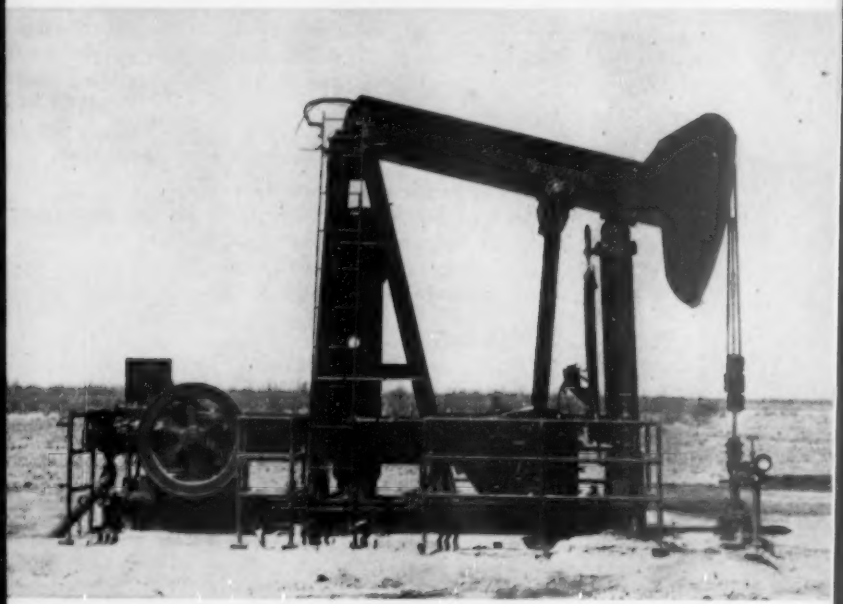
Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

8 BIG ADVANTAGES OF PARKERSBURG *Air Balanced* PUMPERS

1. LOWER INSTALLATION COSTS
2. LESS ROD STRAIN
3. NO COUNTER-BALANCE WEIGHTS
4. LOWER POLISH ROD LOADS
5. LESS HORSEPOWER REQUIRED
6. AUTOMATIC COUNTER-BALANCING
7. MORE PLUNGER OVERTRAVEL
8. LESS VIBRATION

No Crews— No Shutdowns

to change counterbalance



One man can counterbalance the Parkersburg Air Balanced Pumper while it is running and without the use of special tools and equipment. Perfect counterbalance is attained by the simple regulation of a valve to adjust the pressure in the balancing cylinder.

There are no heavy weights to move back and forth on the cranks or beam, attempting to find the counterbalance. No crews are required, nor is it necessary to shut down the well.

Your Parkersburg Representative can point out many ways in which this feature contributes to the lower pumping costs you will enjoy with Parkersburg Air Balanced Pumpers.

5420

THE PARKERSBURG RIG & REEL COMPANY • PARKERSBURG, WEST VIRGINIA

Division of Parkersburg-Aetna Corporation

PUMPERS — Air Balanced • Chain Driven • Gear Driven

They Say—

One Is Thankful . . .

"Perhaps the independence oil companies have of debt financing is the factor that has given rise to the tradition that the oil man wherever one finds him is a rugged individualist. Certainly the financial records reveal him to be a patriot, willing to back his judgment with almost his last dollar and, if he is an investor, satisfied to wait a long time for his total rewards . . .

"It must be a good program, for the oil man has floated the nation through three wars since we mechanized. He has increased production from 275,000 bbl. a day in 1903 to 6,466,000 bbl. in 1953. His search for new pools is unceasing, and production, including drilling dry holes, gets 66.7 per cent of his annual expenditures.

"He has built Tulsa, so . . . we are eternally grateful to him.

"This is a good day to tell him so."

Thanksgiving Day editorial in the Tulsa, Okla., Tribune.

. . . Another Thankless

"Natural-gas producers, always convinced that what is good for their pocketbooks ought to become national policy, are taking to threats and boycott in an effect to wreck regulation by the Federal Power Commission.

"It is no exaggeration to say that they are putting themselves above Government, turning the thumbscrews on northern industry, acting more like robber barons of old than responsible twentieth century businessmen . . .

"Nothing shows up their disregard for the public welfare better than the gas producers' present activities. Nothing better illustrates their 'public be dammed' attitude. Nothing proves better than they need control in the public interest—and, if they persist in their economic bullying, more control than they now object to.

"This is the kind of thing that might lead to demands for public ownership of a natural resource vital to the nation."

Editorial in the Milwaukee Journal.

"Taking Over" Uranium

. . . In my estimation, it is only a matter of time until the oil industry "takes over" this new source of power (uranium). This I am highly in favor of, and I believe a series of articles in the Journal on oil companies and oil per-

Always the same high standard of quality

• It's wise to standardize with these WECO Compounds for tool joints and drill collars. Every gallon of these WECO Compounds has the same unvarying high quality—the same dependable assurance of proper thread lubrication and protection for string after string of drill pipe and drill collars.

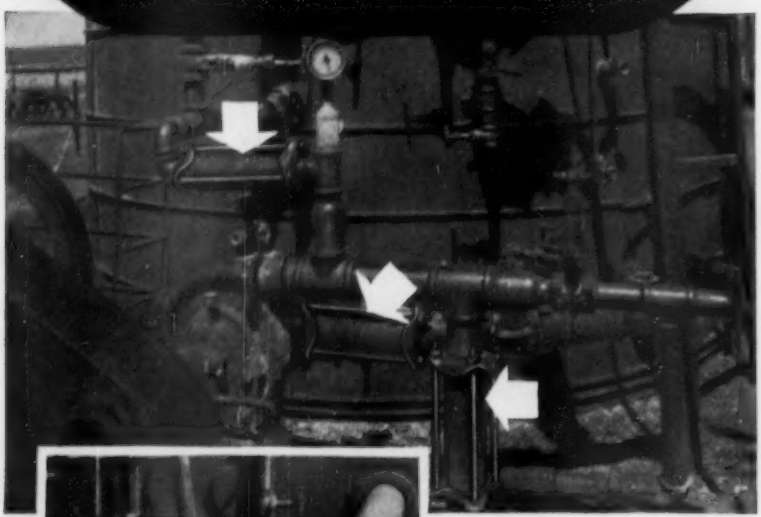
Immediate availability, today and tomorrow, is another important reason why it's wise to standardize with WECO Compounds. Wherever you are—whenever you need them, you can always count on getting WECO NO-GALL and LO-TORK to protect tool joint and drill collar threads.

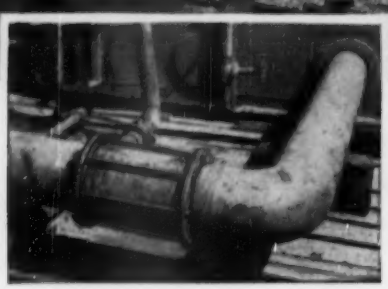
PESA

it's wise to standardize with.. WECO

WECO
WELL EQUIPMENT MFG. CORP. • Division of Chikson Company • HOUSTON 1, TEXAS

around a drilling rig...
the DRESSER way
is easier...surer!





ABOVE—Dresser Style 40 Long Sleeves installed on drilling-rig, salt-water tank lines. LEFT—A 12" Style 40 Long Sleeve installed on mud tanks of rotary drilling rig.

You'll find plenty of uses for Dresser Couplings and Long Sleeves around a drilling rig . . . or anywhere else you're joining pipe.

No pipe threading is necessary and the only tool you need is a wrench. Dresser Couplings are that simple to make up. You get a permanent bottle-tight connection every time—even on offset or deflected pipe.

AVAILABLE AT LEADING OILFIELD SUPPLY STORES

Style 38 Coupling | Style 40 Long Sleeve | Hydrepair*Asbestos Cement Pipe Clamp | Style 63 Expansion Joint | Style 39 Insulating Coupling

*HYDREPAIR is a trade-mark of Dresser Manufacturing Division

DRESSER® COUPLINGS

Dresser Manufacturing Division, 49 Fisher Ave., Bradford, Pa. (One of the Dresser Industries).
Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Airport Blvd., S. San Francisco, Calif.

sonnel now actively engaged in the uranium industry would be very interesting and beneficial to the industry . . .

Max A. Krey
Geologist
Grand Junction, Colo.

The Smog Story

"There are several theories as to the formation of smog, and we are aware that oil refineries can be a source of air pollution if proper precautions are not taken. We have . . . recognized this fact for more than 20 years. The important thing is that we, and other refiners, have been doing something about it for at least that long.

"The petroleum industry in the Los Angeles area has spent more than $20,000,000 to prevent the release of smoke, fumes, and hydrocarbons into the air from its refineries . . . It has cooperated fully and completely with all air pollution control regulations, and is presently 99.8 per cent in compliance with widely publicized smog-control rule No. 56 . . ."

Special memo to shareholders and employes of Standard Oil Co. of California.

A Lofty Goal

"Given enough progress in scientific investigation, we can be sure of progress in practical results in the development of new-energy sources.

"The outcome will be more than a staving off of trouble. It will be a spreading of productive power, a lifting of much of the distress that has shadowed man all his years on earth, a chance for all men to find life a more comfortable, and, perhaps, even a more satisfying experience. This is a lofty goal. But it is outlined in the intensely practical terms of our present situation. We should not consider trying for anything leses."

Monroe E. Spaght, executive vice president of Shell Oil Co., in an address before the Stanford Research Institute in San Francisco.

Federal Price-Fixing

". . . We do not believe that the long-range interest of consumers or of stockholders will be best served by federal regulation of such producers . . . We fear that price-fixing by the Federal Power Commission or even the prospect of such price-fixing will discourage producers from taking the risks involved in further exploration for gas and will cause them to channel such additional natural-gas supplies as may become available into nonregulated uses . . .

"The price paid by consumers is in large measure determined not by the

A Union of Quality and Strength

GUIBERSON SEAL-O-MATIC UNIONS

High in strength because they are high in quality, Guiberson Seal-O-Matic Unions are rugged, heavy duty couplings that stand up to the severest tests.

Double-sealing Seal-O-Matic Ring and metal to metal seat hold working pressures securely. Seal-O-Matic Ring is molded from special oil resistant compound that will not deteriorate in oil, gas or under pressure. All metal parts are made of high tensile alloy steel, accurately machined to assure interchangeability.

Quick and easy to make or break, Seal-O-Matic Unions are ideal for a multitude of uses ...with minimum upkeep and positive, leak-proof seal.

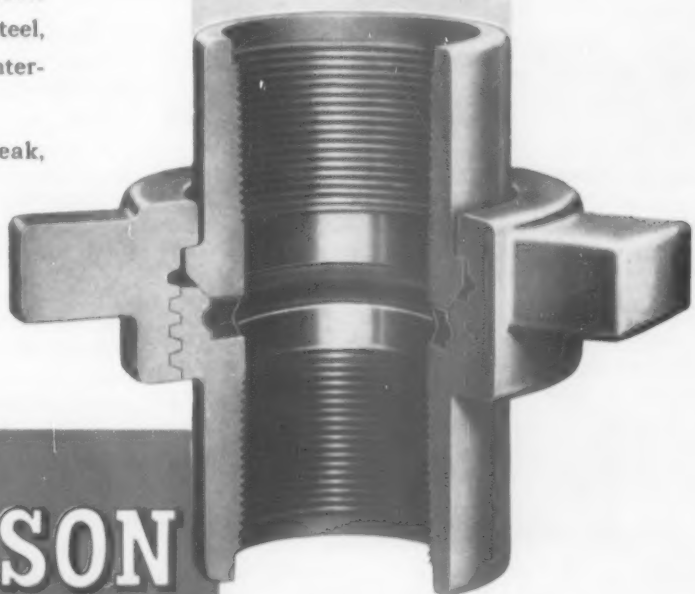
SEAL-O-MATIC UNIONS ARE AVAILABLE IN FOUR PRESSURE RATINGS
BUY THEM BY COLOR

BLUE for **4,000** p.s.i. (without Seal-O-Matic ring)

YELLOW for **6,000** p.s.i.

RED for **10,000** p.s.i.

GREEN for **15,000** p.s.i.



Regular Unions have line pipe thread. Also available in EUE 8 round thread.

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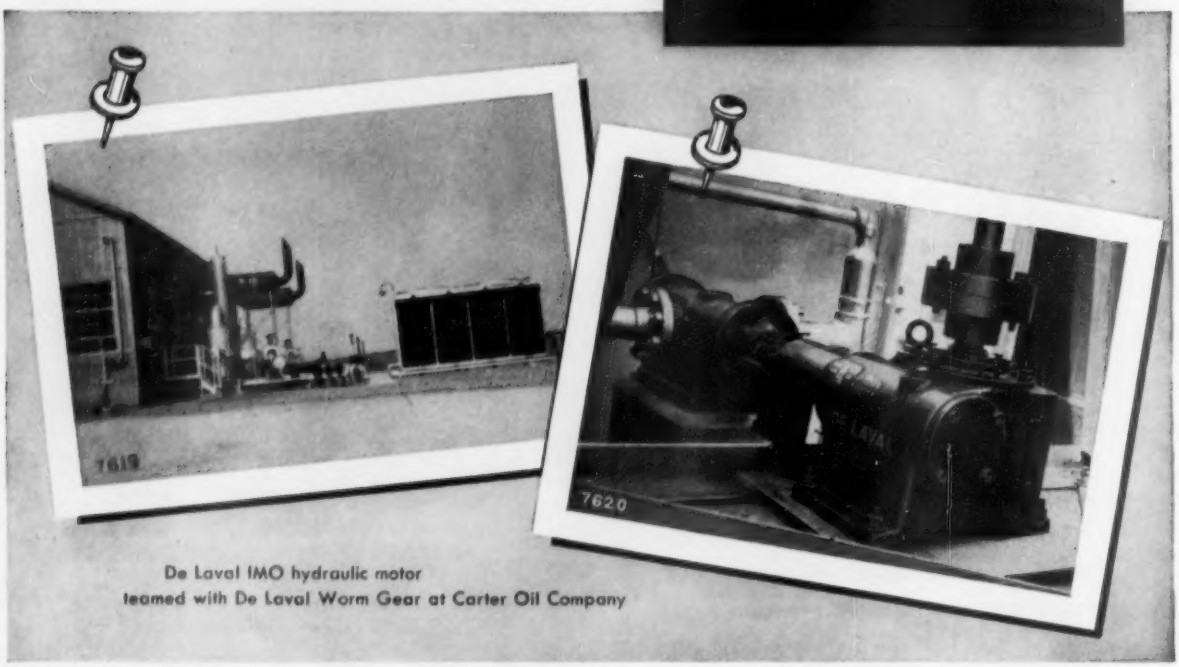
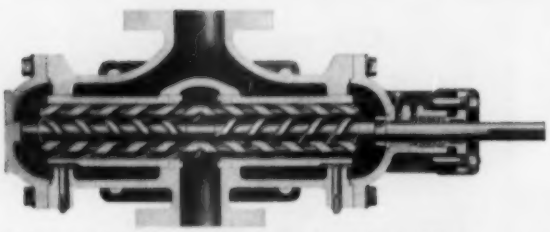
More than two years of trouble-free service with

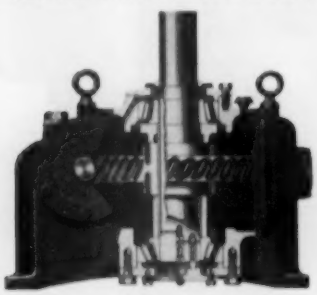
DE LAVAL IMO
HYDRAULIC FAN DRIVE



De Laval IMO hydraulic motor
teamed with De Laval Worm Gear at Carter Oil Company



De Laval IMO A324A hydraulic motor. Capacities to 200 gpm; temperatures to 250 F; pressures to 500 psig.



De Laval Type WVC Worm Gear; 5 to 75 hp; ratios 3⅛:1 to 11⅔:1; center distance 4.00" to 13.50".

De Laval IMO hydraulic motors and pumps have operated twenty-four hours a day for over two years on the Happy Cooling Tower at the Carter Oil Company, Elmore City, Oklahoma Compressor Station.

Fans are driven through De Laval WVC Worm Gear Reducers. There is absolutely no vibration or noise. The equipment has yet to require maintenance of any consequence. Indications point to a long, trouble-free life expectancy.

Here's why De Laval IMO Hydraulic Drives insure trouble-free service. The IMO hydraulic motor has no bearings, no reciprocating parts, no vanes, no timing gears, no intricate sub-assemblies. The drive is in complete hydraulic balance. The simple basic IMO design has only three moving parts.

Call in your De Laval representative. He can solve your problem quickly in the application of De Laval completely standard hydraulic motors, pumps and worm gear reducers. Or, ask your heat exchanger supplier to specify De Laval drives.

DE LAVAL *Hydraulic Drives*

DE LAVAL STEAM TURBINE COMPANY
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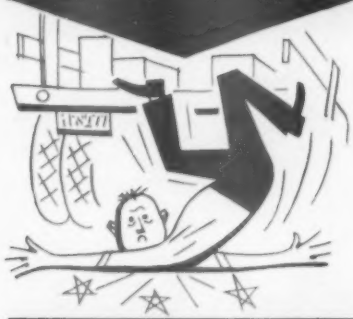
DL-939

MISSTEPS COST PLENTY



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field price of gas but by the cost of transporting the gas from producing areas and by the cost of the complex operation of delivering it to the consumer. The consumer's gas bill would not be changed materially through federal regulation of the field price of gas, and certainly any reduction the consumer would receive would not be sufficient to justify the risk to him that adequate supplies would not be available in the future . . ."

Stuart M. Crocker, chairman, and George S. Young, president, Columbia Gas System, Inc., in a statement to stockholders.

Creeping Controls

"These conditions (resulting from an excess crude supply) have, to an extent, retarded development and slowed down wildcatting where it could be deferred. Approximately one-fourth of the industry's capacity to produce is now idle, without a market . . .

"Until this ruling (the Phillips case) few, if any, believed that it was the intent of the Natural Gas Act of 1938 to regulate the gas sales of independent producers who do not transport gas across state lines and are not affiliated with a company that does . . .

"How can a producer, with the large investment necessary to find and produce natural gas, afford the gamble of contracting for sale of the product when he has no assurance that he will receive the price stipulated in the contract?

". . . This may be the entering wedge toward regulation of crude-oil production and conservation, so well handled in the past by state regulatory bodies. If this type of control can be had for oil and gas, it is but another step to coal, steel, lumber, and automobiles. History is replete with evidence that socialistic controls in production of natural resources lead to a lessening of output . . ."

T. M. Martin, president of Lion Oil Co., in an address before the New York Society of Security Analysts.

Smog Solution Hopes Slim

"It's natural for people to complain when they are inconvenienced or distressed, but it's hard to decide where the smog-afflicted residents of the Los Angeles area should direct their wrath . . .

"It appears that Los Angeles may never rid itself of smog until it does something about its automobiles or about its weather. And the prospects of doing much about either don't look good."

Editorial in the Oklahoma City Daily Oklahoman.

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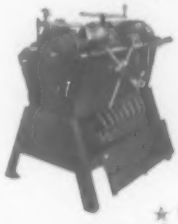
THREADING ½" to 4" PIPE

Bring down Costs!

TOLEDO No. 1-2-4

POWER PIPE MACHINE

makes the job Easier!



★ *Threads 2" pipe in 18 seconds,* 3" in 30, 4" in 42.

★ *Cuts off 4" pipe in 9 seconds* with 4 high speed steel cutter knives, scroll fed.

★ *Instant size change . . .* separate quick-opening die head for each size pipe.

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Toledo, Ohio

Runs 7 Years on the Pump Jack with Only One Overhaul

HARD-WORKING 7-YEAR-OLD INTERNATIONAL U-2 engine has worked continuously with only one overhaul.

Rugged IH engine pays off in Pampa, Texas

For over seven years, a sturdy INTERNATIONAL U-2 engine has been working away for Cree Production Co., down in Pampa, Texas.

Pumper H. N. Sanchez gives the low-down:

"These INTERNATIONALS *are tops for oil field work. They sure start easy and run for years and years. This is one of the first U-2s to come out, and it's only had one overhaul in all these years. One thing for sure, these* INTERNATIONAL *engines don't fall apart on the job!"*

On both small and large operations, smooth-running, multicylinder INTERNATIONAL engines have made a reputation for reliability among oil men everywhere.

Your INTERNATIONAL Industrial Power Unit Distributor can give you details on the whole IH line . . . can show you why INTERNATIONAL Power pays off for years to come.

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CHICAGO 1, ILLINOIS

INTERNATIONAL HARVESTER

INTERNATIONAL
INDUSTRIAL POWER

MAKES EVERY LOAD A PAYLOAD

CALENDAR OF EVENTS

DECEMBER

12-15 American Institute of Chemical Engineers, annual meeting, Statler Hotel, New York.

30 Industrial Science Secton, American Association for Advancement of Science, annual all-day meeting, Hotel Claremont, Berkeley, Calif.

1955

JANUARY

10-14 Society of Automotive Engineers, golden anniversary annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

17-18 Kansas Oil Men's Association, annual convention, Baker Hotel, Hutchinson, Kans.

17-19 Pipe Line Contractors Association, annual convention, Hotel Statler, Los Angeles.

26-28 Symposium on instrumentation for process industries, A. & M. College of Texas, College Station, Tex.

27-28 American Chemical Society, symposium on hydrocarbon chemistry, Rice Hotel, Houston.

27-28 Southern California Meter Association, fourth annual instrument short course, Los Angeles Harbor Junior College, Wilmington, Calif.

FEBRUARY

13-17 American Institute of Mining and Metallurgical Engineers, annual meeting, Conrad Hilton Hotel, Chicago.

13-18 A.S.T.M. Committee D-2 on Petroleum Products and Lubricants, Rice Hotel, Houston.

14-16 Rocky Mountain section of A.A.P.G., annual regional convention, Billings, Mont.

16-18 National Association of Corrosion Engineers, sixth annual short course for pipeliners, Mayo Hotel, Tulsa.

25 National Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

MARCH

4 Southern Gas Association, transmission management conference, Shamrock Hotel, Houston.

7-11 National Association of Corrosion Engineers, Palmer House, Chicago.

9-11 American Petroleum Institute, Division of Production, Southwestern spring meeting, Jung Hotel, New Orleans.

17-18 Southern Gas Association, Distribution Management Conference, Jung Hotel, New Orleans.

20-23 American Institute of Chemical Engineers, Kentucky Hotel, Louisville.

23-24 Pacific Coast Gas Association, accident prevention conference, Santa Barbara, Calif.

23-25 American Petroleum Institute, Division of Production, Mid-Continent District, Herring Hotel, Amarillo, Tex.

24-25 American Gas Association, gas supply, transmission, and storage conference, Wm. Penn Hotel, Pittsburgh.

27-29 Texas Independent Producers and Royalty Owners Association, ninth annual meeting, Hotel Texas, Fort Worth.

28-31 American Association of Petroleum

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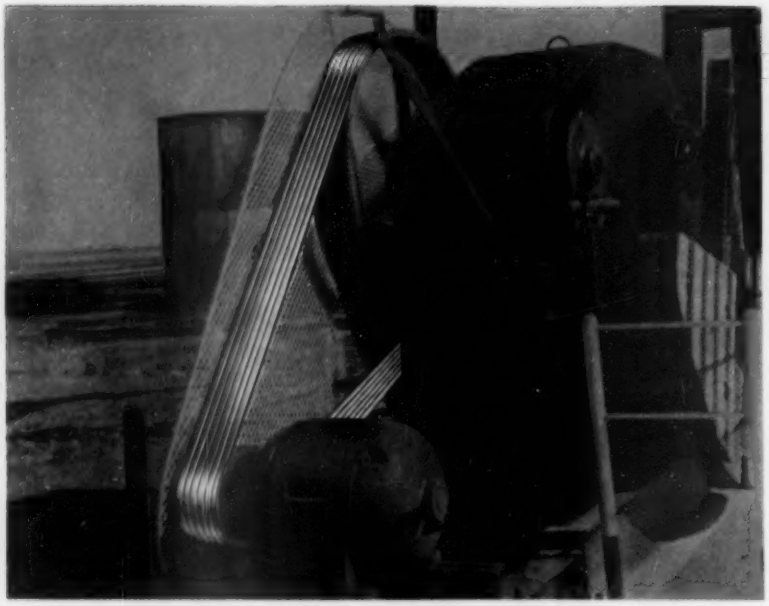

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Here are the facts that explain their outstanding performance: The completely weather-proof cover consists of tough, bias-cut "Hy-Twist" fabric impregnated with special rubber compound. Inside is the load-carrying section with pre-stretched, rubber-coated cords which provide high tensile strength, greater flexibility and high resistance to fatigue. Special blends of natural and synthetic rubbers eliminate distortion and heat build-up, and maintain crosswise rigidity.

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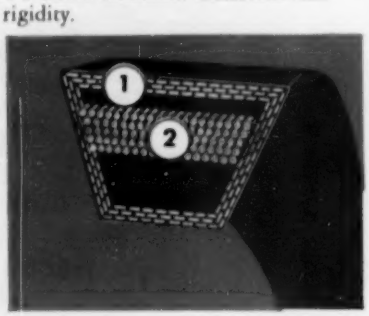
1. "Hy-Twist" fabric for all weather
2. Continuous filament, high twist rayon cord



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DAYTON RUBBER CO., INDUSTRIAL DIVISION, DAYTON 1, OHIO

Geologists, Society of Exploration Geophysicists, and Society of Exploration Paleontologists and Mineralogists, annual meeting, Hotel Statler, New York.

28-April 1 American Society for Metals, ninth Western Metal Exposition and Congress, Pan-Pacific Auditorium, Los Angeles.

APRIL

13-15 Natural Gasoline Association of America, annual convention, Baker and Adolphus hotels, Dallas.

13-15 American Society of Lubrication Engineers, tenth annual meeting, Hotel Sherman, Chicago.

19-20 Pacific Coast Gas Association, distribution conference, Phoenix.

19-21 Southwestern Gas Measurement Short Course, North Campus, University of Oklahoma, Norman, Okla.

28-29 American Petroleum Institute, Division of Production, spring meeting of Pacific Coast district, Statler Hotel, Los Angeles.

MAY

1-4 Liquefied Petroleum Gas Association, annual convention, Conrad Hilton Hotel, Chicago.

1-4 American Institute of Chemical Engineers, Shamrock Hotel, Houston.

9-10 American Gas Association, Gas Supply, Transmission and Storage Conference, Hotel William Penn, Pittsburgh.

9-12 American Petroleum Institute, Division of Refining, midyear meeting, Jefferson Hotel, St. Louis.

11-12 Pacific Coast Gas Association, gas supply and transmission and conference of technical session, Palm Springs, Calif.

14-22 World Wide Chemical Plant and Equipment Exposition and Congress, Frankfurt Germany.

16-18 American Petroleum Institute, Division of Transportation, products pipeline conference, Edgewater Beach Hotel, Chicago.

16-18 Southern Gas Association, New Orleans.

23-25 American Petroleum Institute, Division of Marketing, midyear meeting, Chase and Park Plaza hotels, St. Louis.

26-27 Kentucky Oil and Gas Association, annual meeting, Lafayette Hotel, Lexington.

MAY 30-June 1 Chemical Institute of Canada, thirty-eighth annual conference and exhibition, Quebec City, Que.

JUNE

5-9 Canadian Gas Association, annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont.

6-10 American Petroleum Institute, Division of Production, midyear committee conference, Brown Palace Hotel, Denver.

6-15 Fourth World Petroleum Congress, Rome, Italy.

9-10 Natural Gas and Petroleum Association of Canada, Royal Connaught Hotel, Hamilton, Ont.

9-10 Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh.

16-18 Interstate Oil Compact Commission, Denver.

28-July 1 American Society for Testing Materials, Chalfonte-Hadden Hall, Atlantic City, N. J.

ALL FORGED STEEL
EDWARD VALVES FOR THE OIL INDUSTRY

Fig. 158 Globe

TOP PRESSURE GLOBE AND CHECK VALVES

Ratings — 2" size 7500 lb WOG Smaller sizes 6000 lb WOG

All forged globe stop valves for positive shut-off or accurate pressure control, also dependable ball check valves for protection against sudden reversal of flow, in pressure systems up to 7500 psi. Globe valves have EValloy 13% chromium stainless steel seat, disk and stem. Check valves have EValloy seat, high carbon stainless steel, wear resisting ball. Suitable for liquid or gas services. Alloy steel body used on 2 in. size. Check valves may be installed in horizontal or vertical lines.

Size range: ¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2".

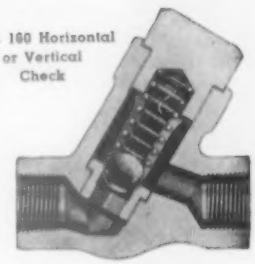

Fig. 160 Horizontal or Vertical Check

Fig. 444 Globe

GLOBE AND ANGLE VALVES

Ratings — 2000 lb WOG 850 lb at 750 F

All forged—all purpose valves ideal for almost all services where small forged steel valves may be used. Streamlined body and rugged bonnet both forged steel. Fig. 444 with union bonnet in sizes 1 in. and smaller. Fig. 448 with bolted bonnet in sizes 1¼, 1½ and 2 in. Bronze bushed yoke, simplified bolted gland design for easy packing adjustment. EValpak high pressure-high temperature die-molded packing. Stem, disk and seat of EValloy 13% chromium stainless steel. Available with screwed or socket welding ends. Angle valves designated Fig. 445 and Fig. 449.

Size range: ¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2".

Fig. 448 Globe

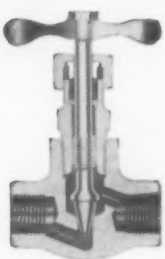

Fig. 152 Globe

GAGE VALVES

Ratings — 4000 lb WOG 600 lb at 750 F

Drop forged, instead of barstock, steel valves for gage, meter, dead-end, instrument and other small lines. Taper threaded bonnet joint. Long taper semi-needle type stem-disk for close regulation and tight seating. Fig. 152 has carbon steel body with EValloy 13% chrome stem-disk. Also available in all 13% chrome stainless steel and in all 18-8 stainless steel. Sizes ¾ and 1 in. have union bonnet. 152J has male inlet, female outlet. Angle valves designated Fig 153 and Fig. 153J.

Size range: ⅛", ¼", ⅜", ½", ¾" and 1".
(Fig. 152J available ½" size only.)

Fig. 152J

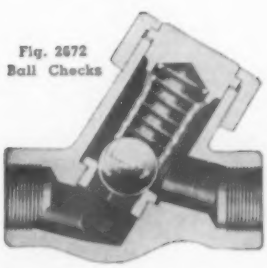

Fig. 2672 Ball Checks

BALL AND PISTON CHECK VALVES

Ratings — 1440 lb WOG 850 lb at 750 F

General service small check valves that give freedom from shock or excessive vibration, yet seat quickly and tightly upon flow reversal. Size 1¼ in. and larger with bolted cover. Sizes 1 in. and smaller with union cover. Corrosion resistant trim in all designs.

Size range: ¼" to 2" inclusive.

Fig. 4638 Bolted Cover Checks

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For Mudline Service Use the EDWARD MUDWONDER — The All-New Alloy Steel Valve

Edward Valves, Inc.

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EDWARD BUILDS . . . a complete line of forged and cast steel valves from ⅛" to 16" in GLOBE and ANGLE STOP, GATE, NON-RETURN, CHECK, BLOW-OFF, STOP-CHECK, RELIEF, HYDRAULIC, INSTRUMENT, GAGE and SPECIAL DESIGNS for pressures up to 7500 psi with pressure-seal, bolted, union or welded bonnets and screwed, welding, or flanged ends . . .

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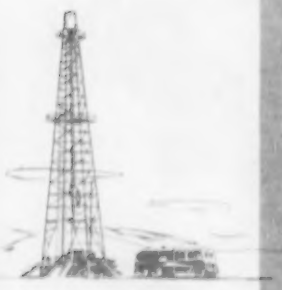

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THE OIL AND GAS
JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa, Oklahoma. Phone 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY Speaking

Animal Crackers

MOST writers, assigned to do a story on oil and animals, become intrigued with the zoological terminology which has become a part of the oil man's lingo. They have a lot of fun with such terms as cat head, rathole, fish, pig, rock hound, dog house, and derrick monkey.

But we're above that sort of thing. For all nature lovers, this department brings a collection of true animal stories—verified by the undoubted authenticity of newspaper clippings.

We'll start with Calico, a cute little kitten who became very much attached to one of Gulf Oil's tank trucks in Michigan. One night Calico crept in between the broad brake drum and the tire rim of the truck's dual wheels and had a nice snooze. Next morning the driver thought he heard a meow, but couldn't find anything. At every stop that day he heard more meows but repeated searches failed to locate the source. It wasn't until he got back to the garage that he spotted Calico. He had to take the wheel off to get her out.

The dizzy kitty had whirled 70 highway miles that day, but Gulf engineers point out that her travel was not in a straight line but followed the pattern of a prolate cycloid. Reach for your slide rule and figure out for yourself what her actual mileage was. Calico now stays away from the truck and hasn't been out for a spin since.

The scene now shifts to northern Canada (the Journal is an international publication, don't forget). Up there in the vast, uninhabited expanses of bush and prairie, oil men encounter huge herds of rabbits, numbering in the thousands. Cute little bunnies they are, but they have peculiar appetites. One of their favorite foods is the insulation on geophysical cables and other electric wires, and their voracious gnawing plays havoc with sensitive exploration apparatus. Rabbit stew isn't the answer, either, for these pesky critters aren't fit for human consumption either before or after dining on insulation. The industry is now looking for a rabbit-repellant-type of cable.

We now take you to a couple of refineries (the Journal covers all divisions of the industry) for some fish stories that Izaak Walton missed by being born 300 years too soon.

At Esso's Bayway refinery is a big steel tank which stores creek water to be treated for boiler feed. The tank is inhabited by a school of carp. Periodically the tank is emptied for inspection, and the fish are removed. But they come back again. How do they do it? The refinery people concluded that they are born there, having been pumped up from the creek in the form of fertile roe. That seems to be the only plausible explanation unless you embrace the theory of spontaneous generation.

Just the opposite happened at Sun's Marcus Hook refinery. The water-storage pond there was breeding mosquitoes, and wiggler-eating fish looked like the answer. Sun's consulting ichthyologist recommended minnows. They ate the wigglers so fast they starved to death, and the mosquitoes took over again. Then Sun tried sunfish (a natural, we would say), and, true to the name of their species and their sponsor, the Sun sunfish have been performing their assigned task very effectively. (With this story you can win a bet that the oil industry employs fish to operate a refinery.)

We'll conclude these tales of the wild with one less distressing, more romantic, and entirely uncommercial —really poetic. It's about our British cousins who traditionally decry the rushing, efficient, eye-on-the-dollar attitude of unesthetic American businessmen.

The Pumpherston Refinery pond of Scottish Oils is a thing of beauty, a gemlike lagoon set in a lovely park. Garlanded with flowering shrubs and bearing a brooch of water lilies on its placid bosom, it is a poet's paradise, an idyllic retreat from the crass commercialism of the adjacent smelly, noisy refining operation. And to make the picture complete—and add a typically British touch—a family of graceful white swans makes its permanent home on the pond as guests of Scottish Oils. Swans in a refinery. Isn't that nice?

Henry D. Ralph.

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by MORE Operators year after year!

VERSATILITY UNLIMITED—From Squeeze Cementing to Testing Formations—from Cementing Two Strings Together to Reducing Gas/Oil Ratios—dozens of important applications are possible with the Baker Cement Retainer which also serves as a Casing Bridge Plug through the use of a Bridging Ball or a Bridging Plug.

The Baker Cement Retainer can be set on an electrical line to bring you savings of both time and money. Also by using the new Baker STINGER SUB, the tubing string can be easily "freed" from the Cement Retainer—see below.

IMPORTANCE OF DRILLABILITY—The Baker CAST IRON Cement Retainer is furnished with the body and most of the parts made of Cast Iron having the physical properties to assure ample strength and maximum drillability. For the *ultimate* in easy drillability, specify the Baker MAGNESIUM ALLOY Cement Retainer.

MAGNESIUM OR CAST IRON—You can select the type of Baker Cement Retainer exactly suited to your needs—the MAGNESIUM ALLOY Type for *temporary* applications, or the CAST IRON Type for *permanent* settings, or where harmful well fluids are present. Either type will provide a perfect pack-off, safe for any pressures that are safe for the casing.

BAKER OIL TOOLS, INC. · HOUSTON · LOS ANGELES · NEW YORK

Now you can have a "FREE" tubing string.

If it is desirable to have a "free" tubing string when cementing, it is a quick and simple matter to disconnect the tubing string from the Retainer when a Baker "Stinger Sub" is used. After the Stinger Sub has been released from the Retainer (by 15 right-hand rotations of the running-in string) the tubing can be set down on the Retainer and the seal on the *maximum bore "stinger"* of the Stinger Sub will seal off in the bore of the Retainer. Operations can then be continued as desired.

BAKER

Never stops ~~working on~~ Solving Cementing Problems

Opponents of free gas prices are working hard

GAS producers don't realize what tough opposition they face in getting Congress to amend the Natural Gas Act to reverse the effects of the Supreme Court decision in the Phillips case.

The necessity for freedom from regulation in producing operations is so obvious, and the onerous nature of the regulations already imposed by the Federal Power Commission is so evident, that producers have difficulty believing that there could be another side to this question.

Two ably staffed industry committees are now marshaling facts and arguments to lay before the public and the lawmakers in support of the producers' case. Most producers seem content to leave their fate in the hands of these groups, confident that the justice of their cause will prevail.

BUT WISHING WON'T MAKE IT SO. It takes votes to amend the law. Votes are made by public opinion. The public is composed chiefly of gas consumers. And consumers are being subjected to a barrage of propaganda in favor of continued regulation—propaganda which may have more telling effect than all the logic and justice which the industry can present.

To gain public support, producers must buck:

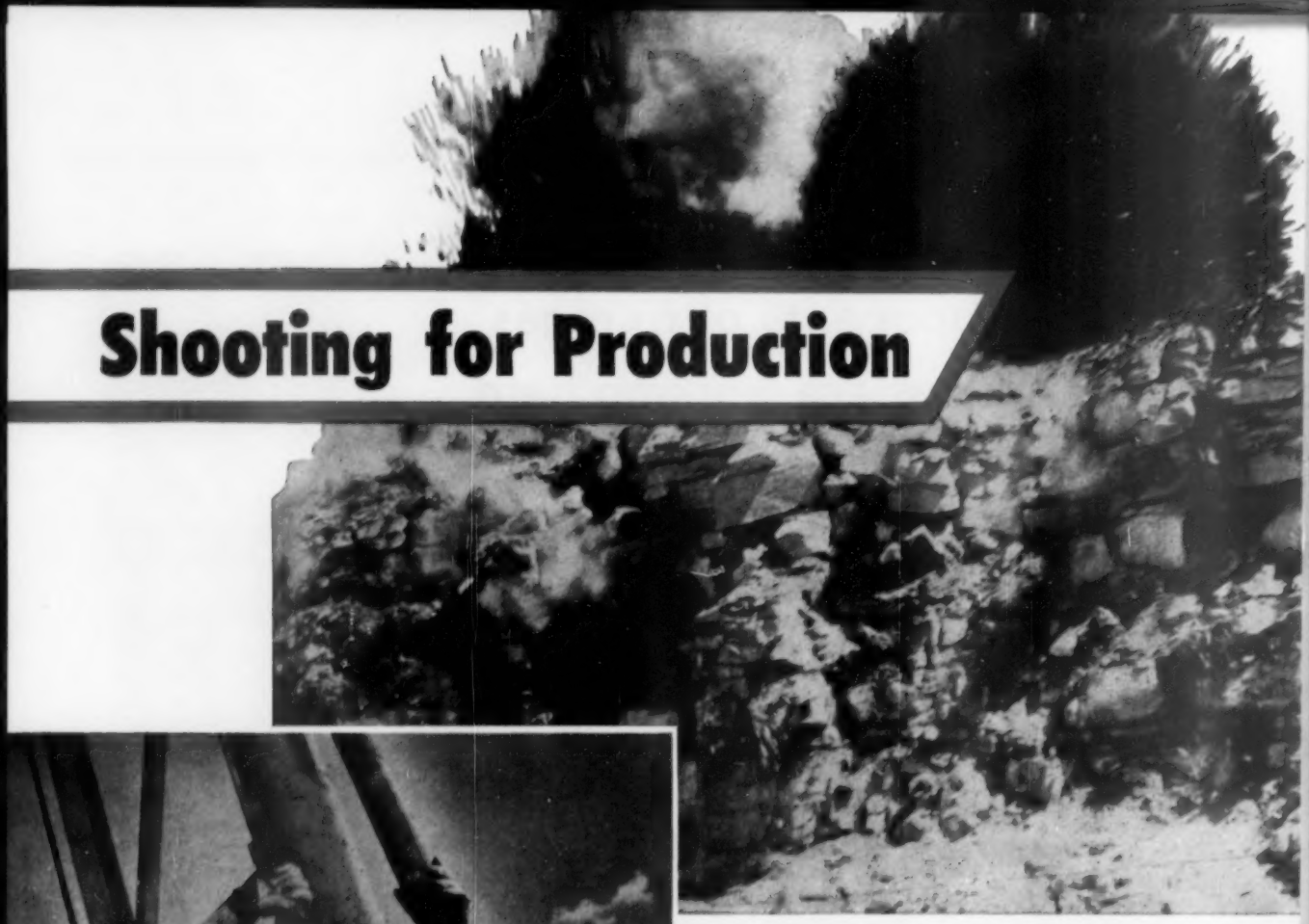
- Some transmission lines, which are dragging their feet or giving only lip service to the cause if not actually working against it.
- A great many local gas-distributing companies, which have always been regulated and which fear that higher gas prices would hamper them in competing with electricity and other fuels.
- A majority of state utility commissions and municipal officials outside of producing areas, who can make political hay out of a show of protecting consumers.
- The "liberal press" and other molders of public opinion, who make it a sacred crusade to promote big government for the protection of consumers against big business.

MORE REGULATION OF GAS is being preached in consuming areas by syndicated and local columnists and editorial writers for large and small papers. Less noticed is a vigorous and continuous campaign being conducted by so-called news letters, fact sheets, and opinion reports. Some of this privately circulated propaganda is from organizations sponsored by prominent citizens of notoriously left-wing politics.

By half truths and insinuations, consumers are being warned that the "oil barons" are preparing a pressure lobby and raising a phony scare of gas shortage.

To overcome such insidious and diversified opposition is a formidable job for just a couple of committees. The help of every individual gas producer will be needed.

Shooting for Production



● A perforating gun entering the casing — familiar sight in the Oil Fields — is a reminder that, when you shoot for production, the properties and performance of the cement behind that casing are of key importance.

Lone Star shoots for production, too—for oil-field production — by engineering into its Oil Well Cements the properties required to assure strong, dense, long-lasting shut-offs under any given set of conditions.

Even before the quarry blast, raw materials are carefully prospected. Knowing their composition, the laboratory checks and adjusts all raw materials —and checks the finished product as well—to assure the required properties for each type of cement.

Let well conditions decide which cement to use . . . let trouble-free performance confirm your choice.

LONE STAR CEMENT CORPORATION

Offices: DALLAS • HOUSTON • ABILENE, TEX.
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NORFOLK • RICHMOND • WASHINGTON, D. C.

Select Cement to Fit the Job!

THIS WEEK... ...IN THE NEWS

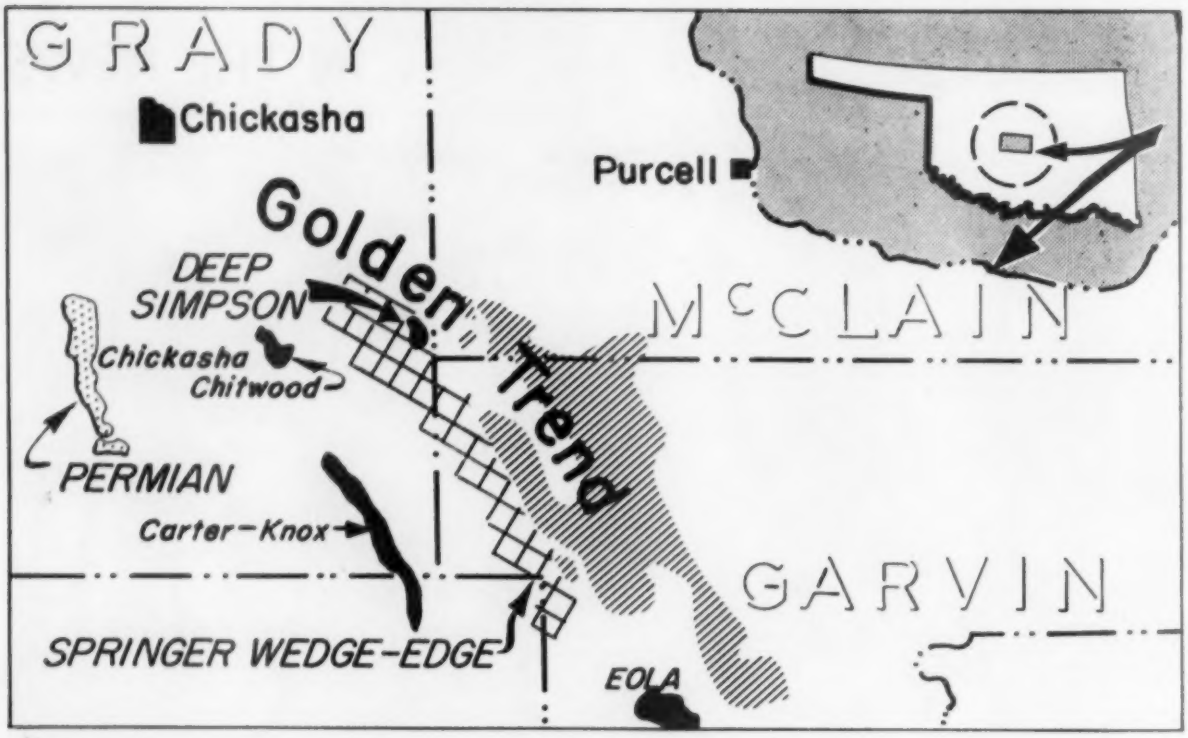
A CONSTANT FIGHT against the stormy China Sea confronts oil operators in British Borneo, which has the most prolific oil field in the Far East. British Malayan Petroleum Co. (Royal Dutch-Shell), which is stepping up offshore exploration there, is now constructing a sea wall to protect the Seria field from flooding. Seria field shown here produces from formations underlying both the sea and dry land. (For a comprehensive review of current oil activity in British Borneo, turn to page 99.)

EXPLORATION—Three separate plays, all bypassed by operators in the past, are making Oklahoma's Golden Trend the most active area in the United States. . . . There are 114 rotary rigs active in Garvin and Grady counties developing these sands. . . . ¶Four-company syndicate has what promises to be British Columbia's first commercial discovery 35 miles northeast of Fort St. John. . . . ¶Sinclair's apparent discovery in Elbert County may give Colorado another producing county. . . . ¶Monoco Oil Co. has significant oil strike in East Baker area, 7 miles east of Baker, Mont. . . . ¶Extensions and new, deep, prolific gas-condensate sands in Lake Arthur area of Louisiana step up drilling and development. . . . Drilling is now under way on both edges of South Lake Arthur field. . . . ¶Sun Oil completes gas discovery off Padre Island to give Texas its second offshore field. . . .

PIPELINES—Pacific Northwest Pipe Line and Westcoast Transmission may be negotiating a deal that will call for revamping Pacific Northwest's plans to bring natural gas to Washington and Oregon and for importing Canadian gas from the Peace River area. . . . Moving additional gas to California also is in the deal. . . . ¶Three-man group appointed by Defense Mobilization Director Flemming is taking another look at possibility of a Texas-to-California pipeline. . . . Pressure from congressmen reportedly is why Flemming named the new study group. . . . ¶Intrastate natural-gas line is proposed in Kansas primarily to serve Wichita industries by Clint Murchison interests of Dallas. . . . Line needs approval of state. . . .

INTERNATIONAL—Increase in free-world oil production is anticipated, following fourth successive monthly drop. . . . Output for first three quarters is 2.8 per cent above a year ago. . . . ¶British Malayan Petroleum Co. steps up exploration activities in North Borneo, where it already has Far East's most prolific oil field. . . . ¶Standard Oil Co. of California plans to build first major refinery in Hawaii. . . .

SECONDARY RECOVERY—Sale of properties held by Moncrief group ends long battle over unitization of Kelly-Snyder field in Scurry County. . . . Sale consisted of 42½ wells purchased for $20,986,000 by firm that will operate for benefit of Southern Methodist University. . . . Land will be included in SACROC unit. . . . ¶Pressure-maintenance project started by Gulf Oil Corp. in West Texas' Goldsmith field. . . . Program includes unusual setup of piping water 30 miles from Hendrick field. . . .



Sands, once bypassed, make . . .

Oklahoma Area Hottest in Nation

- **Three separate plays in Oklahoma's Golden Trend keep 114 rotary rigs busy; activity to continue through 1955**

- **All three were originally passed up by operators who regarded them as too deep, tight, or uneconomic**

Norman Morrisey

SANDS once considered worthless will produce more than 100 million barrels of oil on Oklahoma's Golden Trend, the most active area in the United States today.

Armed with better geology and a new tool—fracturing—the industry took another look at prospects it passed up 16 years ago. It liked what it saw.

There are 114 rotary rigs active in Garvin and Grady counties developing sands passed up in earlier drilling or considered uneconomic when they were first drilled. This high level of drilling will continue through 1955 and perhaps longer.

Springer sand production is the sparkplug that has fired the play and it continues to expand daily. If present stepout and extension wells are successful, at least 500 wells will be drilled during the next year or two. Many companies, faced with expiring leases, must drill or face the expensive job of renewing acreage on a known producing trend. Companies undoubtedly will drill all available acreage themselves or develop it by farmouts.

Proved or semiproved production from this wedge-edge covers approximately 40 sections. Tentative reserve estimates indicate ultimate recovery from the truncated Springer sand will exceed the 100-million-barrel mark.

Three separate plays are responsible for the area's surge in drilling. They are:

. . . **Deep Simpson** production at 10,000 to 14,000 ft.

. . . **Springer sand** pinchout at 9,500-10,500 ft.

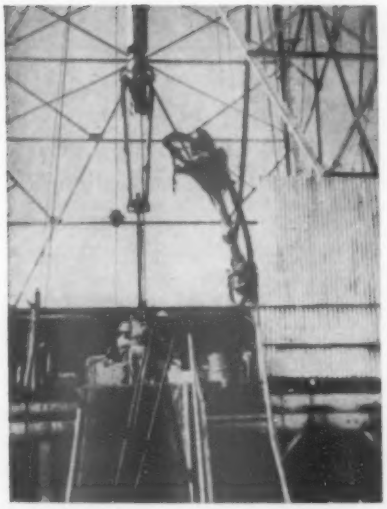
. . . **Shallow Permian sands** at 3,200-3,500 ft. on the crest of the Chickasha gas field.

All were originally condemned by drilling. In some cases operators drilled through the sands looking for deeper pays. In others they considered the sands too tight or too deep for commercial production. Wells with estimated reserves of 500,000 bbl. were even plugged and abandoned.

The present drilling campaign is the result of increased knowledge of the geology of the area and more advanced completion methods.

Springer production . . . The development history dates back to 1938, when the first Springer test was drilled. The zone was considered too tight for commercial production and very little deep drilling was done in the area until 1947 when Stanolind Oil & Gas Co. drilled its 1 Briscoe. The well temporarily became the deepest producer in Oklahoma with production from Simpson sands below 14,000 ft. It had 85 ft. of Springer sand that yielded only a show of oil on a drill-stem test. Stanolind finally plugged the well as noncommercial.

Meanwhile developments to the east on the Pauls Valley uplift showed that



COMPLETING a Springer well, this crew is running tubing before making tank battery connections.

WORKED OVER and completed as a Springer producer this well is one of several Springer "dry holes" that have come to life as a result of the new play on Oklahoma's Golden Trend that has made it the most active area in the United States.

the Springer sands pinched out between the Carter-Knox oil field in Grady County and the Pauls Valley trend. The possibilities of this play, however, were overshadowed by the active drilling of the Deese sands on Oklahoma's Golden Trend during 1946-1950. This did not retard the lease play that blocked up the acreage.

Deese drilling in McClain and Garvin counties spread rapidly after the completion of the Globe Oil & Refining Co. and Vickers Petroleum Co. 1 Melinda Gibson in February 1946. This well established production from the Deese sands that pinch out against the Pauls Valley uplift. As the Deese drilling was extended to the southwest, the possibilities of the Springer wedge-edge became more apparent. Magnolia Petroleum Co. finally proved Springer production with its 1 Howell-Gragg in 14-4n-5w. This well, originally plugged as a dry hole, was completed in October 1952 as the first Springer well in Grady County on the wedge-edge.

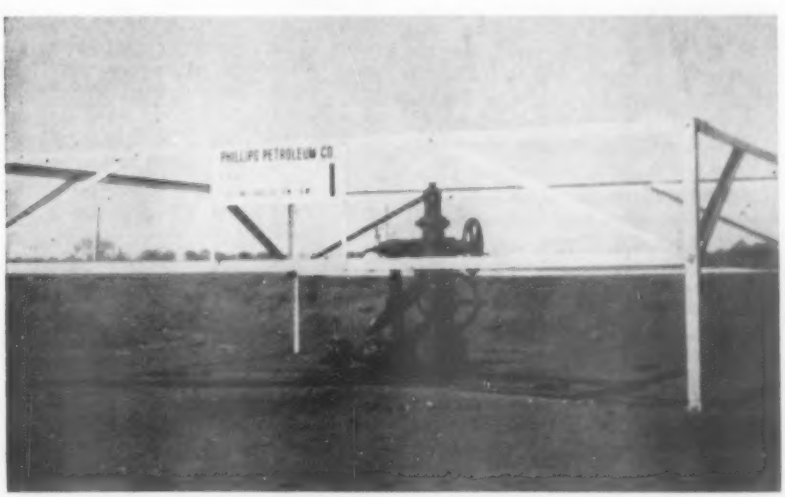
From this inauspicious beginning, the Springer production has snowballed into a development of major proportions with nearly 300 producing wells.

The main producing zone, the Cunningham, pinches out against the Pauls Valley uplift to form a series of oil fields that cover an area 16 miles long and 2 miles wide. Future drilling undoubtedly will connect many of the present fields.

Completion methods . . . Although some of the Springer wells are completed natural, the usual practice is to fracture the pay before completion. Sand development is erratic and thicknesses vary considerably along the Springer wedge-edge. Wells on the trend are completed in only 40-45 days, depending upon the depth to the main sand. The Springer wells normally flow 300-400 bbl. of oil per day after fracturing. In addition to the Springer, the Hart sand produces 700-900 ft. higher in the section. Many wells are dually completed since the Hart is not as prolific as the Springer and may not be economic by itself.

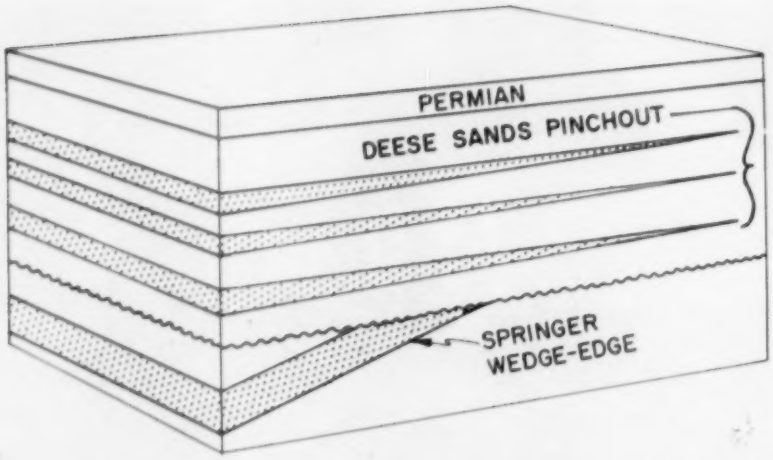
Many of the old dry holes have been worked over and completed as Springer producers.

Deep Simpson production . . . Phillips Petroleum Co. completed its 1 Steve in



DEEPEST oil production in Oklahoma comes from the basal Oil Creek from 13,735-13,804 ft. in the 1 Steve drilled by Phillips Petroleum Co. Five separate zones give the well a potential of 2,087 bbl. per day.

HYDRAULIC PUMPS like this one on a Springer well are new sight to Oklahoma oil fields.



THE SPRINGER WEDGE-EDGE will eventually produce over 100 million barrels on Golden Trend. The oil is trapped below the unconformity at the base of the Deese and locally faulting is an important factor. Deese sands pinch out against the Pauls Valley uplift to form a tremendous oil reserve.

the Simpson sands as the deepest producer in Oklahoma in September 1954. Because wells on this play are expensive, drilling is proceeding at an orderly pace with only eight rigs active. Geologists originally considered the Simpson sands in the area either too tight or too deep for commercial production. Completion of the Steve, however, indicates that isolated well control cannot be used to condemn a nearby prospect. Five separate zones in the 1 Steve had a total potential of 2,087 bbl. per day from 323 ft. of perforations.

Geological interpretation in the area is complicated because of the faulting.

Chickasha . . . Production from Permian sands at 3,200-3,500 ft. has rejuvenated drilling in the old Chickasha gas field. The area has been especially attractive to independents because of the shallow depths and possible farmouts, but it is getting difficult to acquire acreage now. The oil companies prefer to develop their own acreage because the economics of the play are so attractive. The wells are completed in about 7 days with initial potentials of 200 bbl. of oil per day flowing. Because of reduced allowables, the wells are cut back to 15 bbl. per day.

The Noble-Olsen and Fortuna sands, the new producing zones, were originally passed up during the early Chickasha gas development. Operators were seeking deeper Pennsylvanian sands and apparently ignored the shallow possibilities or considered them uneconomic.

Correlative zones produce in the neighboring Cement field and P. A. Wallace, consulting geologist from Oklahoma City, reasoned that similar sands should exist on the Chickasha structure. Geological studies confirmed his conclusions. General Drilling Co. established production from the zone in early 1954, but the play received little attention until the past few months.

Other activity . . . Although the three plays mentioned above account for the majority of activity in Garvin and Grady counties, other areas are hot.

Simpson production at Eola keeps 10 rigs busy developing a complexly faulted field; principal pay zones are Simpson sands at 8,000 to 11,500 ft. Wells at Eola are expensive, many of them falling in the $500,000 category, but the thick sands and multiple pays justify the risks.

Eola was discovered by Sohio Petroleum Co. in 1947, but development has been retarded because of the complex geology and high drilling costs. The discovery well, the 1-A Howard, required 424 days to drill and complete at a total depth of 10,234 ft. Drilling time has been slowly reduced until now 11,000-ft. test is completed in less than 150 days.

Oil possibilities in the deep Simpson sands have spurred development drilling on the north flank and the central part of the Eola field during the past year. Eola is still expanding and will eventually become an important oil reserve in southern Oklahoma.

Stanolind Oil & Gas Co. has completed the 1 Pitchlynn (SE SW SE Section 14-4n-2w) as a successful wildcat for an initial potential of 1,066 bbl. of 40°-gravity oil from the Bromide sand. This is only one of several recent discoveries in this part of Garvin County as a result of detailed seismic and subsurface work.

CANADA

Province Gets Oil

British Columbia's first commercial discovery made

FORT ST. JOHN.—British Columbia is promised its first commercial oil discovery of importance at Northern Foothills Agreement's 1 Boundary Lake, 35 miles northeast of here.

The discovery well is N.F.A.-Texaco 1 Boundary Lake, LSD 6, 6-86-13w6. It is 2 miles west of the Alberta border. Triassic dolomite was found at 4,060 ft. Oil flowed in 45 minutes on a drill-stem test at the rate of 8 bbl. hourly. Gravity was 34°.

Northern Foothills Agreement is a syndicate composed of Socony-Vacuum Oil Co. of Canada, Ltd., Canadian Gulf

Oil Co., Texaco Exploration Co., and Shell Oil Co. of Canada.

The province has had two previous indications of commercial production.

The first indication was 3 years ago at Peace River Allied 1 Fort St. John. This wildcat recovered oil on drill-stem tests of the Permo-Pennsylvanian, but was suspended as a noncommercial well. Only last summer, the Pacific Petroleums, Ltd., group came up with a promising well, 1 West Buick Creek, which is 23 miles north of the Fort St. John region gas production. It tested light-gravity oil, but later was completed as a gas producer.

Crude Line Started

REGINA.—Construction has started on a pipeline outlet for crude from Smiley and Eureka fields.

Mid-Saskatchewan Pipe Lines, Ltd., is building the 24½-mile line from the fields to the Interprovincial Pipe Line Co. pump station at Kerrobert. The main line will be 6 and 8 in. in diameter. Capacity will be 12,000 bbl. daily.

Deal May Be Brewing to Bring

. . . Canadian Gas to U. S.

SAN FRANCISCO.—Pacific Northwest Pipe Line Corp., a company with approval to supply the Pacific Northwest with natural gas, and Westcoast Transmission Co., the Canadian firm that fought a 2-year, losing battle for the same territory, may be making a deal that will overshadow any previous proposals to bring gas to this area.

The deal not only involves bringing the Pacific Northwest its first gas, but also includes piping gas into California.

Two other big names in the natural-gas industry are involved in the negotiating—Pacific Gas & Electric Co., California's biggest gas utility, and El Paso Natural Gas Co., a firm that has two big-inch lines running into southern California.

G. L. McMahon, Westcoast vice president, said last week that negotiations with "U. S. West Coast interests" are "proceeding well" in his company's efforts to export gas from the Peace River area of British Columbia and Alberta to the United States.

"We are confident a satisfactory deal for sale of large quantities of Peace River natural gas into the U. S. Pacific Northwest states will emerge," McMahon declared.

Closing such a deal would mean building a natural-gas line from the Canadian fields into the U. S.

McMahon's firm battled Pacific Northwest Pipe Line vigorously before the Federal Power Commission in an effort to win the Pacific Northwest franchise. However, the FPC denied Westcoast Transmission's bid in favor of Pacific Northwest Pipe Line's plan to supply the area with gas from the San Juan basin *(The Oil and Gas Journal, July 5, page 84)*. The plan approved by the FPC calls for gas to move from the basin to northern Oregon and most of Washington.

What may happen . . . The new plan that may be in the making calls for El Paso Natural to deliver part of the San Juan gas to distributors in northern California. These deliveries would be in addition to those Pacific Northwest Pipe Line would make to Oregon and Washington.

The deal also may mean that Pacific Northwest Pipe Line and Westcoast will interconnect so that Canadian gas could be delivered to some of the area.

If the Pacific Northwest-Westcoast deal is completed, it will mean more hearings before the FPC on how the Pacific Northwest will be served with natural gas and whether some of this supply will be imported into the U. S. This latter element was what defeated Westcoast's original plan to serve the area.

California's supply . . . F. M. Foster of Southern California Gas Co. predicted earlier this year that California will probably need additional out-of-state gas by 1960 *(The Oil and Gas Journal, October 18, page 85)*.

A large percentage of the state's present gas supply comes from New Mexico and Texas. El Paso Natural has a line running from the San Juan basin that connects with a Pacific Gas & Electric line near Needles and another line running from southern Texas that joins Southern California Gas Co. at Blythe.

Kansas Line Planned

Intrastate carrier would serve Wichita industries

WICHITA.—Plans for construction of a 16 to 20-in. natural-gas pipeline from southern or southwestern Kansas to Wichita were revealed last week by Kansas Pipe Line Corp., Inc., a newly organized company.

The proposed line, which would supply gas primarily to industrial users in the Wichita area, is contingent on approval of the Kansas Corporation Commission. Since it would be an intrastate line, it would not come under jurisdiction of the Federal Power Commission.

The new pipeline firm is backed by the Clint Murchison interests of Dallas.

President of Kansas Pipe Line is Curtis W. Cannon, who also is president of Frontier Chemical Co., Wichita, a wholly owned Murchison affiliate. Vice presidents of the new firm include J. W. Bartlett and W. J. Bowen, both vice presidents of another Murchison company, Delhi Oil Corp., Dallas. Another Frontier Chemical officer, Wesley H. Sowers, also is a vice president of Kansas Pipe Line.

Gas supplies . . . Originating point for the proposed line, which would carry an estimated 100,000,000 cu. ft. of gas daily at capacity, has not been decided definitely.

If possible, Cannon said, the line will start in the Barber-Harper County area just north of the Oklahoma line, less than 100 miles southwest of Wichita. It may be necessary, however, to go farther west to Hugoton field to secure adequate supplies of gas, he said.

Cost of a line beginning in the Barber-Harper County area would be about $5,000,000, Cannon estimated.

Another company official said Kansas Pipe Line currently is lining up reserves for the line. He said the line would be able to provide gas for commercial use at less than the present rate and with fewer interruptions caused by cold-weather increases in residential consumption.

Penn Grade Rises

Buyers increase postings 10 to 12 cents a barrel

REFLECTING a better demand from refiners, principal buyers advanced all grades of Pennsylvania Grade crude oil 10 or 12 cents per barrel as of December 1.

The principal buyer, the Joseph Sepp Purchasing Agency of the South Penn Oil Co., announced the following increases:

Bradford District oil in Bradford District Co. lines, $3.35, a 12-cent advance.

Bradford District in National Transit Co. lines, $3.35, a 12-cent advance.

Middle District Grade in National Transit Co. lines, $3.25, a 10-cent advance.

Pennsylvania Grade in National Transit Co. lines (Southwest division), $2.93, a 12-cent advance.

Pennsylvania Grade in Eureka Pipe Line Co. lines, $2.82, a 12-cent advance.

Fluctuations . . . The advances are the second increases made in some grades of Pennsylvania Grade crudes after the extreme lows were established earlier in the year in a reflection of unsatisfactory refined market conditions at that time for products.

Over a period of less than a year, Bradford Grade crude postings dropped from a high of $4.40 to a low of $3.00. Southwest Pennsylvania decreased from $3.91 to $2.70 with comparable adjustments in other grades. A year ago Bradford crude oil was posted at $4.05 and Southwest Pennsylvania, $3.61. Less than 50,000 bbl. daily is involved

in the latest advances in the posted prices.

For years, wide differences were maintained between Pennsylvania Grade crudes and other domestic postings. The premium position of the former was usually $1.50 or more per barrel. The differences were based on the large yield of premium lubricants from the Pennsylvania Grade crude and the fact that the crude was produced and refined within the eastern marketing areas.

In recent years Pennsylvania Grade prices have been determined largely by local conditions with changes up and down more frequent than in other domestic areas. During the low-price period earlier in the year some of the Pennsylvania Grade quotations were under those posted for the higher gravity Mid-Continent crudes.

Merger Restudied

Chemical union may seek to change O.W.I.U. plan

WASHINGTON.—The United Gas, Coke and Chemical Workers Union will take a long, hard look at the fine print before approving the constitution which would merge it into one big C.I.O. family with the Oil Workers International Union.

The governing board of the chemical union has scheduled a meeting in Cleveland February 26, at which time representatives of the various locals may submit their proposals concerning the merger constitution. The chemical workers will convene 2 days before the date set for finalizing the merger with their cousins in the oil industry.

O.W.I.U.'s proposal for amalgamation was accepted by the chemical union September 15 at its St. Louis convention. But a vociferous minority objected strenuously to the proposal on grounds that the O.W.I.U. will dominate the smaller group.

The proposed constitution is being studied by G.C.C.W. locals to determine what changes, if any, they desire in its provisions. Alternative suggestions are being submitted to union headquarters.

There are indications the comparatively peaceful G.C.C.W. may be wary of recent strike threats made by O. A. (Jack) Knight, president of O.W.I.U. *(The Oil and Gas Journal, November 22, page 59).*

A ratification meeting originally was set for November 15 but was postponed at the insistence of the smaller union.

The O.W.I.U., whose leadership is highly in favor of the merger, will meet in Cleveland February 25. It is expected to give quick approval to the amalgamation plan and get other business out of the way before meeting jointly with G.C.C.W. February 28 *(The Oil and Gas Journal, November 15, page 162).*

Despite the apparent caution being exercised by the smaller union, officials of both organizations appear confident that the merger will be ratified on schedule.

Meanwhile, leaders of both unions are considering an intensified drive to get non-C.I.O. unions in the oil and chemical industries into the merged organization. A coordinated effort to increase membership is expected as soon as the merger is consummated.

New Plant Announced

San Angelo carbon-black works will be first of several scheduled; five others from Gulf Coast to Canada spotted

SAN ANGELO, Tex.—Lynn Carbon Black Co. revealed last week that it intends to build for research and development purposes a full-scale carbon-black plant in this area.

The plant will use the Lynn "Furmatic" process, according to Rice P. Lynn, president of Lynn Carbon Black and inventor of the process. Lynn said the right to build an experimental plant was retained when the company signed a contract giving Consolidated Carbon Corp., Chicago, world rights to manufacture carbon black by the Lynn method.

Neither the exact location or capacity of the experimental plant has been determined, but a decision is expected soon.

Output of the plant, which will be operated in conjunction with Lynn's product research efforts, will go to a new fertilizer plant which is being built by Consolidated Carbon in Chicago.

This plant, Lynn said, will produce a new pelleted, organic fertilizer which is conventional in every respect except that it contains 12 per cent carbon black. Lynn said it has been known for some time that carbon black is potentially a valuable fertilizer ingredient due to its soil loosening and its heat and moisture retaining properties. The difficulty has been that black is so light that it is too easily dispersed by wind or water.

The Consolidated Carbon plant at Chicago, he said, employs an extruding process operating at a pressure of 2,900 psi., which will circumvent this drawback.

Carbon-black raw material for this plant, he said, will be obtained from a plant operated in Louisiana by Thermotomic Carbon Co., a subsidiary of Commercial Solvents Corp., until the Lynn and Consolidated Carbon Black plants begin operations.

Five plants spotted . . . Consolidated Carbon, Lynn said, has located sites for five new carbon-black plants using his process and will decide this month when construction will start. Two of the plants will be located in Louisiana, and one each in North Dakota, Wyoming, and Canada, Lynn said.

Lynn's contract with Consolidated Carbon, announced in July *(The Oil and Gas Journal, July 19, page 75)*, called for the latter to build one new plant a year for 10 years. The first was to have a gas-processing capacity of 2,500,000 cu. ft. daily, and the remainder to have a minimum capacity of 5,000,000 cu. ft. daily. Lynn's announcement last week would seem to indicate that present plans involve speeding up this schedule.

Design of the plants is to be handled by Dr. W. H. Balka, Dallas consulting engineer and vice president of Lynn Carbon Black Co.

Reprints for Supervisors

The Journal's Reader Service Department has reprinted a new eight-page bulletin on "Rules for Supervisors." These helpful references are from the article series "Want to Be a Better Supervisor?" published in November 22, 1954 edition, pages 81-85, plus other related items from recent issues.

Included are: How to Get the Most Out of Interviews, Don't Let Gripes Become Grievances, How Thorough Is Your Breaking-in Technique?, Helpful Hints on Selling Company Policy, What the Employe Expects of His Supervisor, Planning to Meet Management Goals, Morale —And How to Help Build It, Making the Most of Company Policy, Know the Facts About Employe Morale.

Send your orders to: Reader Service Department, The Oil and Gas Journal, P. O. Box 1260, Tulsa 1. Prices: Single copies, 20 cents; 10-100, 15 cents; 100 or more, 10 cents.

In addition to the black plants, Lynn indicated that Consolidated Carbon plans a series of fertilizer plants similar to the facility now going up in Chicago.

The process . . . The "Furmatic" process, according to Lynn, incorporates most of the better features of the thermotomic, channel, and furnace processes and eliminates the objectionable features without infringing on any of these methods.

The process can be used to make four different types of black simultaneously and can operate using natural gas or a mixture of gas and oil as feed, Lynn said. Yields from the process are claimed to average higher than those from any other process now in use.

An added advantage is that the plant is entirely automatic and smokeless, Lynn added.

Kirby Sale Proposed

Offer involves $1 million cash, production payments

HOUSTON.—Continental Oil Co. has offered to buy producing properties of Kirby Petroleum Co. in seven states, subject to the approval of Kirby stockholders.

Conoco last week confirmed its offer for 120 producing oil and gas wells in 32 fields, but disclosed no details of the financial transaction. A letter to Kirby stockholders, however, revealed that the deal involves a cash outlay of $1 million plus three separate and involved production payments to be made over a period of years.

Kirby's stockholders will meet December 18 to consider the offer. About 80 per cent of Kirby's stock is controlled by the family interests of Clint W. Murchison, Dallas, and Sid Richardson, Fort Worth.

Conoco's offer involves producing wells in Texas, Louisiana, Mississippi, New Mexico, Nebraska, Arkansas, and North Dakota. It also includes Kirby's royalty and partnership interest in natural-gasoline and cycling plants at Katy, Tex., and Ville Platte, La.

If stockholders approve the sale, Kirby Petroleum Co. will be dissolved. The company has been an oil and gas producer since 1921.

Co-ops to Talk Troubles

WASHINGTON.—Problems of cooperative refineries are expected to be brought up for consideration next month at the annual meeting of the National Council of Farmer Cooperatives to open at the Edgewater Beach Hotel in Chicago January 6.

The oil situation will be discussed at a session of the petroleum group, which is expected to review such matters as the import situation, new developments in the industry and marketing problems.

Industry Briefs

BATON ROUGE.—December's oil-production allowable for Louisiana has been set at 622,771 bbl. daily, an increase of approximately 12,000 bbl. per day over the November quota. Conservation Commissioner John Hussey said the increase is allocated to new production.

OKLAHOMA CITY. — Oklahoma's crude-oil allowable for December has been set at 495,000 bbl. daily, unchanged from the November total.

WASHINGTON.—Three oil and gas leases comprising 392 acres of land within the known geologic structure of Lake Bistineau field, Bienville Parish, about 4 miles from Davis, La., will be sold to the qualified bidders of the highest cash bonuses by the Bureau of Land Management, January 12.

BEAUMONT. — The largest barge ever built for transportation of anhydrous ammonia has been launched by the Bethlehem Steel Co.'s yard here. The barge, built for Shell Chemical Corp., will be used to move the product from Shell's Pittsburg, Calif., plant 700 miles to a new terminal at Portland.

WICHITA. — Kansas crude-produc-tion allowable for December was set at 325,000 bbl. daily, unchanged from the November quota.

OWENSBURG, Ky. — Texas Gas Transmission Corp. proposes to merge its two South Louisiana gas-gathering subsidiaries — Louisiana Natural Gas Corp. and Texas Northern Gas Corp.—into the parent company. The proposed merger is subject to approval of the Federal Power Commission.

NEW YORK.—Keel for a 25,200-ton tanker to be built for Sinclair Refining Co. has been laid at the Sparrows Point, Md., shipyard of Bethlehem Steel Co. It is the first commercial ship construction started in an American yard since early 1953.

A.P.I. Refinery Report, November 26

(Excludes all jet-fuel components)
(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks† Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1953 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	927	391.6	30.7	232.4	182.7	33,196	14,219	50,403	9,801	1,028	436.8	34.4	247.0	217.2
Appalachian:														
District 1	95	44.9	7.0	20.7	5.0	4,250	760	2,591	479	115	51.7	6.5	24.6	12.5
District 2	80	38.1	6.7	14.4	8.1	2,467	503	778	319	88	45.2	5.7	14.5	11.9
Ind., Ill., Ky.	1,280	701.0	83.9	263.1	160.1	31,157	9,541	25,386	4,211	1,336	738.4	79.9	249.5	195.2
Okla., Kans., Mo.	636	345.1	24.4	143.0	43.7	13,431	2,408	12,993	1,439	592	351.3	17.0	133.1	50.3
Inland Texas	220	173.0	8.9	38.9	19.9	5,656	346	2,309	1,340	230	177.7	8.5	42.7	30.9
Texas Gulf Coast	1,809	857.4	133.4	406.6	246.4	21,559	3,863	17,586	5,762	1,692	826.4	123.0	402.2	243.8
La. Gulf Coast	604	299.9	51.9	178.4	35.3	10,283	3,185	5,158	1,575	552	282.8	60.9	124.7	47.0
N. La. and Ark.	89	41.1	6.1	26.0	5.6	3,846	796	1,770	130	88	37.7	8.5	20.1	7.2
Rocky Mountain:														
New Mexico	20	11.1		3.9	2.9	190		84	37	20	12.5	0.4	3.0	3.6
Other Rocky Mtn.	243	111.0	5.6	55.6	32.9	5,143	272	2,235	706	219	112.5	4.8	48.9	38.1
California	971	432.9	0.4	172.4	351.8	18,013	351	13,623	29,714	1,027	455.9	4.5	153.1	365.1
Nov. 26, 1954	6,974	3,447.1	359.0	1,555.4	1,094.4	149,191	36,244	134,916	55,513	6,987	3,528.9	354.1	1,463.4	1,222.8
Nov. 19, 1954	7,016	3,360.7	355.0	1,588.7	1,146.7	147,224	36,155	135,353	55,872					
Nov. 28, 1953	7,083	3,456.1	342.7	1,499.7	1,167.3	147,684	35,285	132,902	50,908					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

This week's A.P.I. refinery report is being carried in the news section while last week's report is on page 203 in the current statistics section. Last week's report was omitted due to Thanksgiving.

AMARILLO HELIUM plant operated by the Bureau of Mines.

Government will expand its . . .

Profit-Making Helium Operation

Bertram F. Linz

WASHINGTON.—The Bureau of Mines is planning a $6 million expansion of its profit-making helium production to meet an increasng demand which threatens to outstrip present production within a year.

In what is apparently the first concrete step in the program, the bureau's helium operations last week were reorganized under a separate unit to center at Amarillo, Tex.

The last session of Congress provided money to either expand or modernize present helium production facilities or build a new plant. The designation last week of E. M. Frost, chief of the engineering divison, as the man to handle development of a new helium plant apparently means the Government will build new facilities.

Wherever located, it is fairly certain the new facilities will be somewhere along the route of the Colorado Interstate Gas Co. line transporting gas from the Keyes field in Oklahoma.

The gas from Keyes field not only contains 2 per cent helium, but has a nitrogen content of 20 per cent. This high nitrogen content has made the gas difficult to market because of its low B.t.u. content. The problem in the past has been whether or not the Government should extract the nitrogen along with the helium.

No sale to industry . . . The expansion of helium production scotches a report, quickly denied by Interior Secretary Douglas McKay, that the Government has considered disposing of its helium facilities to private interests.

The bureau processes both commercially produced and its own natural gas and makes the operation profitable. Commercially produced gas is metered as it enters the plant and again when it leaves after the helium has been extracted. The bureau pays for both helium and the gas used as fuel at the going gas rate. The residue natural gas from the plant at Amarillo is sold for fuel after helium is extracted from the Government's own natural gas. Residue gas from the Shiprock, N. M., plant consists largely of nitrogen and is discharged to the atmosphere.

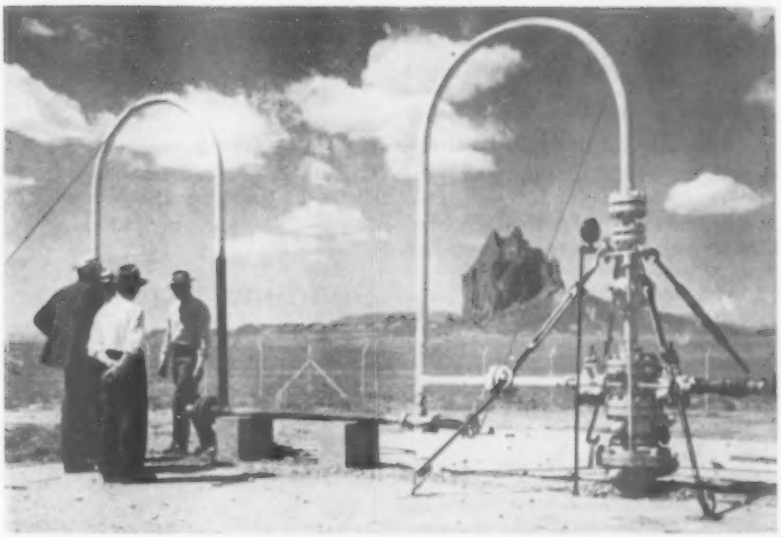
Helium's history . . . Today's helium industry is the outgrowth of a World War I experiment in the use of gas for dirigibles when three experimental plants were built to process gas from the Petrolia field in Clay County, Texas.

The first full-scale helium plant, however, was not built by the Interior Department, but by the Navy in 1921 near Fort Worth. It also processed natural gas from Petrolia field. In 1925, Congress placed that plant and all other government helium operations under the Bureau of Mines. The first of the present four plants was built in 1929 near Amarillo and the Fort Worth plant was closed.

During World War II, plants were built at Excell, Tex., Shiprock, N. M., and at Otis and Cunningham, Kans. The Cunningham plant was dismantled after the war.

The Exell and Otis plants are on commercial pipelines and process gas on its way to market. Gas for Exell comes from the Channing area in Moore, Potter, and Hartley counties of the Texas Panhandle, and gas for Otis comes from the Otis field in Rush and Barton counties in Kansas.

The Amarillo plant is supplied from government-owned gas rights in about 50,000 acres covering the entire geologic structure of the Cliffside field in Potter County. The Shiprock plant takes gas from the Rattlesnake field in San



SHIPROCK which gives the New Mexico helium plant operated by the Government its name is shown here in the background. The gas well is a helium source in Rattlesnake field on Navajo Indian lands.

Juan County, New Mexico, where the Government holds the gas reserves under a long-term lease with the Navajo Indians.

Processing . . . In processing the gas, the plants extract carbon dioxide and nitrogen, which can be used as well as helium. The helium content of natural gas ranges from 7½ per cent in the Rattlesnake field of New Mexico down to a mere trace in some commercial fields. The bureau does not now use gas with less than 0.7 per cent helium content.

Reserves . . . Estimates place the helium reserves for the Shiprock plant at about 800,000 M.c.f. and for Amarillo at 2,000,000 M.c.f. The estimated reserve in the Keyes field may be as high as 10,000,000 M.c.f.

While some storage capacity for excess production has been installed at all the plants, the total probably does not exceed 10,000,000 cu. ft. During low demand periods, plants operating on government-owned gas can be shut down and all operations confined to the Exell plant.

Excess helium produced at Exell can be piped by a high-pressure 2-in. line to a well in the federally owned Cliffside field and injected into the producing formation, enriching the gas in place. It can readily be reclaimed by the Amarillo plant.

Production and uses . . . Helium production hit a wartime high of 237,268,000 cu. ft. in 1944 and dropped to a low of 54,000,000 cu. ft. in 1949. Last year, production reached 170,000,000 cu. ft. and is expected to top 209,000,000 for the current fiscal year.

The rated capacity of the four government plants is around 200,000,000 cu. ft. a year, but they can operate slightly above that level. It is anticipated this year's demands will be met in full.

About 70 per cent of the helium consumed is used by the Government. The remainder is sold commercially, about two-thirds of it to contractors working on government orders.

Major government uses for the gas are for welding and other purposes in atomic energy production. It provides needed pressure behind the fuel in guided missiles and the Navy uses helium for its lighter-than-air blimps in submarine searches. It is also used for weather and atmosphere research and by various agencies for research and medical treatment.

Major industrial uses are in shielded arc welding and for medical purposes. Another industrial application — for which the bureau would like to see less valuable argon substituted—is as an oxidation preventive in the production of titanium.

The bureau's helium operation is more businesslike than most governmental industries. It has something over $12 million invested in plant and facilities and the investment is being written off at the rate of about $600,000 a year.

Required to operate on a self-sustaining basis, the operation is actually showing a profit.

The helium produced is sold to other government agencies at cost—$14.65 per 1,000 cu. ft.—and to commercial buyers at $19 per 1,000 cu. ft. About 90 per cent of the gas sold commercially goes to one company which resells to consumers. It is from these commercial sales the Government makes its profit.

Helium Operation Shifted

WASHINGTON.—Reorganization of the helium operations of the Bureau of Mines will center the work at Amarillo, Tex., under a separate unit of the bureau and independent of its regional organization.

The unit will be under the direction of Dr. C. W. Seibel, assistant bureau director for helium activities. Only a small liaison office headed by H. S. Kennedy will be maintained in Washington.

Under the new set-up, P. V. Mullins will be chief of operations in immediate charge of production, pipelines, gas fields, plant engineering, and administration. George E. Erlandson, chief of the production division, will be responsible for the separation and distribution of helium output.

Development and construction of a new helium plant for which Congress has provided funds will be handled by E. M. Frost, chief of the engineering division. George Shelton, chief of the gas-fields operations division, will be in charge of the bureau's four gas fields, its 13 wells, and nearly 200 miles of transmission pipelines.

Tax Collections Drop

WASHINGTON.—The Treasury Department collected $953,212,000 from direct taxes on oil during the fiscal year ending June 30.

Because of a quirk in collection procedures much of the revenue for the final quarter of the year did not come in until July. Actual tax liabilities on sales of gasoline, motor oils, diesel fuel and pipeline transportation will probably be more than the $1,007,465,000 collected in fiscal 1953.

Under a new system payments of most excise taxes are put on a quarterly instead of a monthly basis. Returns are due by the last day of the month following each quarter. As a result, most last-quarter collections were outstanding when the Treasury closed its books for the year June 30.

Because of this change, the Internal Revenue Service's annual report shows a drop of $55,066,000 in collections from gasoline and $4,880,000 from lubricating oils, partially offset by increases of $3,965,000 from diesel fuel and $1,728,000 from pipeline transportation.

FPC Clouds Order

Commission now uncertain about best method for setting value on gas produced by natural-gas pipeline companies

WASHINGTON.—The Federal Power Commission cast a cloud last week on its own ruling that natural-gas pipeline companies should be permitted to value the gas they themselves produce at the field price.

Because of the situation created by the Supreme Court decision giving it jurisdiction over producers and gatherers of natural gas, the commission now is uncertain as to how pipeline-company production should be valued for rate-making purposes.

The uncertainty was disclosed in an order allowing the El Paso Natural Gas Co. an increase of $10,237,098 annually in its wholesale rates, out of $13,307,238 proposed.

The FPC allowed $4,973,958 which the company claimed represented the current field price of its own gas production.

But, the commission indicated, it was not now prepared to say that the field price or the rate base or some other method of determining the company's cost of production was most appropriate under present circumstances. That problem is among those that will be discussed at hearings to open December 15 on the methods to be applied in fixing independent producers' rates.

Other issues . . . Several other issues were involved in the El Paso case, some of them decided by a split vote.

The commission, on division, excluded from the company's cost of service payments, $1,000,000 which the company made under the Texas statute levying a gathering tax on gas. The Supreme Court later held the tax unconstitutional. The company claimed this cost because it had paid the tax, no part of which will be refunded. The FPC majority declared El Paso should have recognized the possibility the tax might be declared unconstitutional and could have done so without entailing any obligation to actively prosecute a suit, since a number of other interstate pipeline systems already had instituted proceedings. The company made a mistake, the commission majority held, and it, rather than the ratepayers, should bear the cost.

In another issue, the commission adopted the system-wide method of allocating cost of service between jurisdictional and nonjurisdictional sales rather than the "peak responsibility" method proposed by the company. The commission adopted the system-wide method, suggested by its staff, after turning down another staff proposal for a zone method of allocation on the ground it was more complex and raised numerous controversial questions. Commissioners Nelson Lee Smith and Claude L. Draper favored it. Also, in the decision, the commission reiterated its belief that 6 per cent is an adequate return on investments in interstate pipeline systems, rejecting a plea of the company for a 6½ per cent return as "fair, reasonable and adequate."

The commission's policy of allowing pipelines to value their own gas production at the field price was made in a decision allowing increases in rates of the Panhandle Eastern Pipe Line Co. *(The Oil and Gas Journal, April 26, 1954, page 120).*

Line Studied Again

New committee looking into defense line to West Coast

WASHINGTON.—A new study of proposed Texas-California pipeline project is being made by the three-man group appointed by Defense Mobilization Director Arthur S. Flemming.

On the basis of this study, it may be decided whether the pipeline is of sufficient importance militarily to warrant government support of its peacetime operations.

The project has been knocking around Washington for several years. Neither the Defense Department nor the Petroleum Administration for Defense or the Oil and Gas Division has ever approved government participation beyond the allowance of accelerated tax amortization. There is no indication that either the Defense Department or the OGD has changed its position.

Flemming group . . . Appointment of the study group by Flemming is reportedly a result of pressure from members of Congress for a review of the project. It was significant that the three men appointed to do the job were businessmen with no connection with the oil industry who presumably would be free from industry thinking and influence in considering the matter.

The group is studying the entire problem of oil transportation to the West Coast, the availability of crude and products for military use in the Pacific and the capacity of the West Coast refineries to meet wartime requirements.

The Defense Department, though repeatedly requested, has consistently refused to issue a letter of essentiality for any pipeline to the West Coast, holding that additional transportation facilities to the Atlantic Seaboard are a first requisite.

Deadline Extended

Cabinet committee's report still under consideration

WASHINGTON.—The Cabinet Committee on Energy Supplies and Resources Policy will not report to the White House until next week.

The report has been completed but is now before the members of the committee for possible modifications. The report deals with such matters as suggestions from domestic producers that quota restrictions be imposed on oil imports and counter contentions of the importing companies that this is a matter for settlement within the industry; representations from the natural gas and coal industries that the Federal Power Commission should be deprived of any authority to regulate independent producers and gatherers, and proposals by the coal industry for imposition of end-use controls on gas and federal control of residual fuel imports.

Deadline extended . . . The December 1 deadline for the committee's report was extended by President Eisenhower at the request of Mobilization Director Arthur S. Flemming, who said additional time is needed for study of the matter by committee members.

The cabinet committee is composed of the heads of the departments of State, Interior, Justice, Defense, Commerce and Labor. It was set up by the President July 30 to evaluate all factors pertaining to the continued development of energy supplies, resources, and fuels. Its aim is to strengthen national defense, provide orderly industrial growth, and assume supplies for the national economy and for any future emergency.

Studies were made by a task force on which J. Ed Warren, former head of the Petroleum Administration for Defense, was responsible for oil. The group submitted its report to Flemming November 24 but up to the December 1 deadline he had not been able to get the committee together for its consideration.

Details of the recommendations are being closely guarded but it is reported they include proposals for some form of voluntary program under govern-

ment auspices to keep residual fuel imports at their current level and adjust crude imports to domestic refining operations. It is also believed the group favors amendment of the Natural Gas Act to provide exemption from FPC control for independent producers and gatherers as necessary to proper expansion of natural-gas supply.

Papers Flood FPC

Industry awaits promised revisions in Order 174-A

WASHINGTON.—Not by the dozen but by the hundredweight, applications from producers for authority to sell natural gas to interstate pipelines came in to the Federal Power Commission before the December 1 deadline.

The industry, meanwhile, was awaiting an announcement modifying the order, promised by the commission "very shortly." What the changes will be was a secret closely guarded by the commission. It disclosed its intent in a telegram to the Carter Oil Co., Tulsa, but failed to give any details.

Making the announcement public, the commission said it "not only anticipates substantial compliance with Order No. 174-A but recognizes the desire of some companies to seek court review." The modified order, which will be the final 174-A based on arguments received in the public hearing in September, will afford that opportunity, it added.

There was some speculation that the commission might decide on-lease sales of casing-head gas are not subject to federal control. But if the modified order does not cover that point, the commission may act on it directly as a result of hearings which opened last week before an examiner. Deep South Oil Co. and Shell Oil Co. seek exemption for such sales.

A number of similar petitions have been received from other producers who will be allowed to participate in the hearing as intervenors.

Depletion Ruling Made

WASHINGTON.—The Internal Revenue Service ruled last week that in the cases of production leases where the lessee pays rental on producing plant and equipment owned by the lessor, the rental payments must be included in the gross income of the latter. They must be excluded from the gross income of the lessee in determining percentage depletion allowances.

Since the lessee has no capital investment in the equipment he may not take depreciation, but rentals measured by time are deductible expense.

WATCHING WASHINGTON

Bertram F. Linz

Imports Have Backing

Any effort of the domestic-oil producers to secure import relief from Congress next year will be countered by important groups with world-trade interests.

This was made clear late last month in a statement on United States tariff policy by the Committee for Economic Development.

CED is a nonprofit, nonpolitical economic research and education organization with a membership of 150 leaders in industry, finance, and education. Oil members of the board of trustees are M. J. Rathbone, president, and Jay E. Crane, vice president, of Standard Oil Co. (N.J.), and T. S. Petersen, president of Standard Oil Co. of California.

An important plank in the CED platform is a "liberal policy" for imports of natural-resource commodities where tariffs or other restrictions may result in speeding up the exhaustion of "scarce" domestic supplies, thus cutting down our reserves for an emergency and tending to impair our national security.

"Since the future rate of discovery of domestic reserves exploitable at reasonable costs is always in doubt," it was held, "we ought, in time of peace, to use foreign sources of supply to meet a large part of our current needs for these commodities, safeguarding our reserves for future use in the event of an emergency."

There may be cases where for military or technical reasons the domestic output of basic raw materials should be maintained at a level higher than would be possible if the tariff were lowered, it was admitted. But in those cases, the CED recommended, subsidies might be preferable to maintaining tariff protection.

Offshore Leasing Plans

The Interior Department got its feet wet in Continental Shelf oil leasing this fall and found the wading invigorating financially.

But the department isn't going to rush back into the water. It'll probably be February or March before additional leases off Louisiana and Texas are offered.

Sometime over the next 3 months oil companies will be asked to nominate the tracts on which they might bid. When the department puts them up for sale, it may make another try at moving some of the approximately 100 tracts on which no bids were received in October and November, and may include the blocks which Kerr-McGee Oil Industries, Inc., got on bids which later were canceled.

By the time the next sale rolls around, the department hopes that the Louisiana situation may have cleared up. Louisiana officials have threatened to enjoin any oil and gas operations inside the state's claimed boundary. The boundary was set by the legislature at 3 leagues with a headland-to-headland line as the base, and some of the leases sold in October are inside that border.

Meanwhile, the Department of Justice has been giving some thought to proceedings to settle the boundary line, not only of Louisiana but of Texas as well where, until the Louisiana claim was voiced, there had been little effort in Washington to contest the 3-league limit.

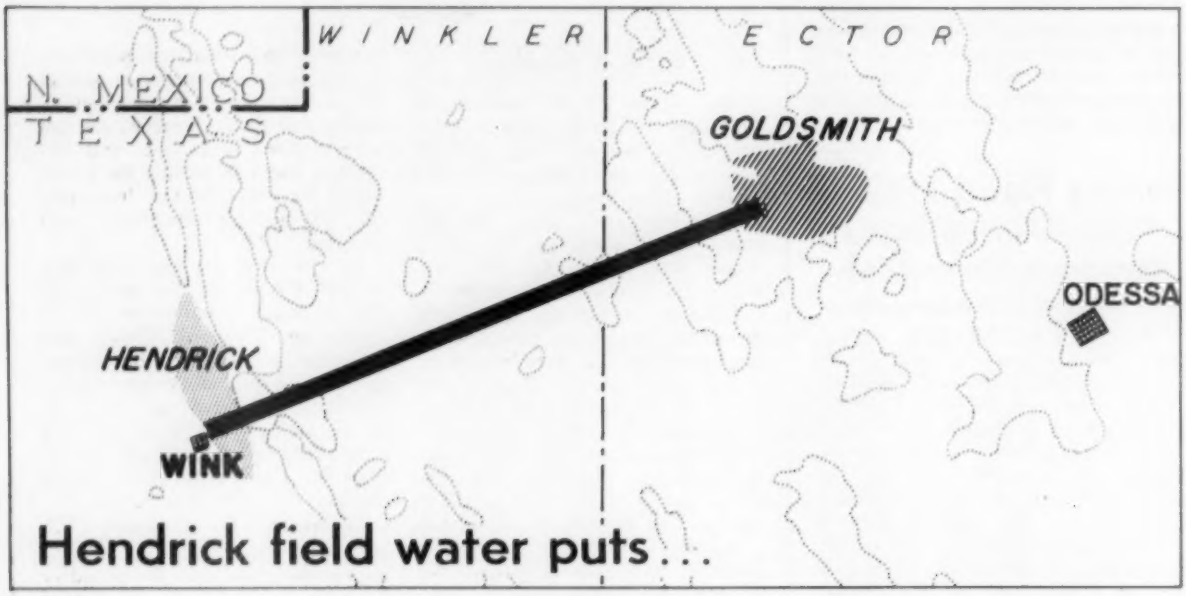
Sale of Plants Slow

The Rubber Facilities Disposal Commission apparently isn't too optimistic over its chances of developing a program for the sale of the government synthetic-rubber plants that will meet the approval of Congress.

The testing point is now approaching. The commission must conclude its dickering by December 27, then sit down to write its sales program.

The main point of disagreement appears to be the potential earning power of the individual plants. That, rather than cost to the Government, depreciated book value, or replacement cost, is the base on which the commission hopes to make its sales. But there are big differences of opinion on what the plants will do once they are in the hands of industry.

After December 27 the commission will draft sales recommendations for consideration by the Department of Justice from the antitrust point of view. A month later, the selling plan and the department's opinion must be laid before Congress, where either house may vote against the whole program or individual sales.



Big Goldsmith Unit in Operation

- Injection water for West Texas pressure-maintenance program is piped from 25-year-old field 30 miles away.

- Unit engineers say plan will stabilize bottom-hole pressure in prolific San Andres dolomite at 1,000 psi.

Robert J. Enright

ODESSA, Tex.—Gulf Oil Corp. has pushed the button starting 60,000 bbl. of water daily coursing through 31 input wells ringing the south dome of huge Goldsmith field and the water is coming from 30 miles away.

As operator of the Goldsmith San Andres Unit, Gulf has instituted one of the biggest and most significant pressure-maintenance programs ever undertaken in a major West Texas oil field. The water is injected into the prolific San Andres dolomite at about 4,200 ft.

The big unit covers approximately 18,400 acres of the 31,000 proved productive acres in the field, and takes in 571 of the field's 1,050 producing wells.

Production from the unitized portion of the field has reached 76,000,000 bbl. of oil. Even after nearly 20 years of production, the unitized area is still capable of making its allowable of some 16,250 bbl. per producing day and is considered far from depleted. Pressure maintenance is expected to recover many additional millions of barrels.

Injection of gas into the San Andres in the south dome area was begun on a nonunitized basis in 1951 and is being continued and coordinated with the water flood. The water is being injected below the oil-water contact to fill the reservoir void caused by production. Gas is being injected into the field's broad gas cap to keep the gas-oil contact in its present position.

The 31 water input wells are located in two roughly concentric rings around the perimeter of the south dome. Ten were drilled as input wells and the rest are converted producers. Four gas injection wells, also converted producers, are on the crest of the structure in the east-central portion of the unit area. The high-pressure dry gas now going into the gas cap at the rate of about 9,500,000 cu. ft. a day is obtained from Phillips Petroleum Co.'s natural-gasoline plant in the field.

Unit participants in addition to Gulf are Phillips and Pure Oil Co. Gulf owns 78.5 per cent of the unit, while Phillips and Pure own 10.75 per cent each.

Unusual water setup . . . Ground water in the flat and arid Goldsmith area is practically nonexistent.

The unit thus was forced to go 30 miles to old Hendrick field near Wink, in Winkler County, to find an adequate water supply. This field, a vigorous producer 25 to 30 years ago, produces about 500,000 bbl. of water daily from wells in the last stages of depletion.

Gulf gets approximately 60,000 bbl. of water daily from five wells completed in the Hendrick reef at about 3,500 ft. The wells are produced by turbine-type pumps into nearby storage facilities. The stored water is pumped by three electric-motor-driven centrifugal pumps through a 30-mile, 18-in. pipeline to the injection plant at Goldsmith. It passes through high-pressure rapid sand filters and is moved through the distribution system and into the injection wells by three gas-engine-driven quintuplex pumps.

The water wells and pump station are operated manually, but controls have been installed to permit automatic operation later on.

Present capacity of the injection plant is between 60,000 and 70,000 bbl. of water daily at a pressure of 1,000 psi. Safety equipment has been provided throughout the plant.

The field and the unit . . . The north and south domes comprising Goldsmith field were discovered in 1934 and 1935.

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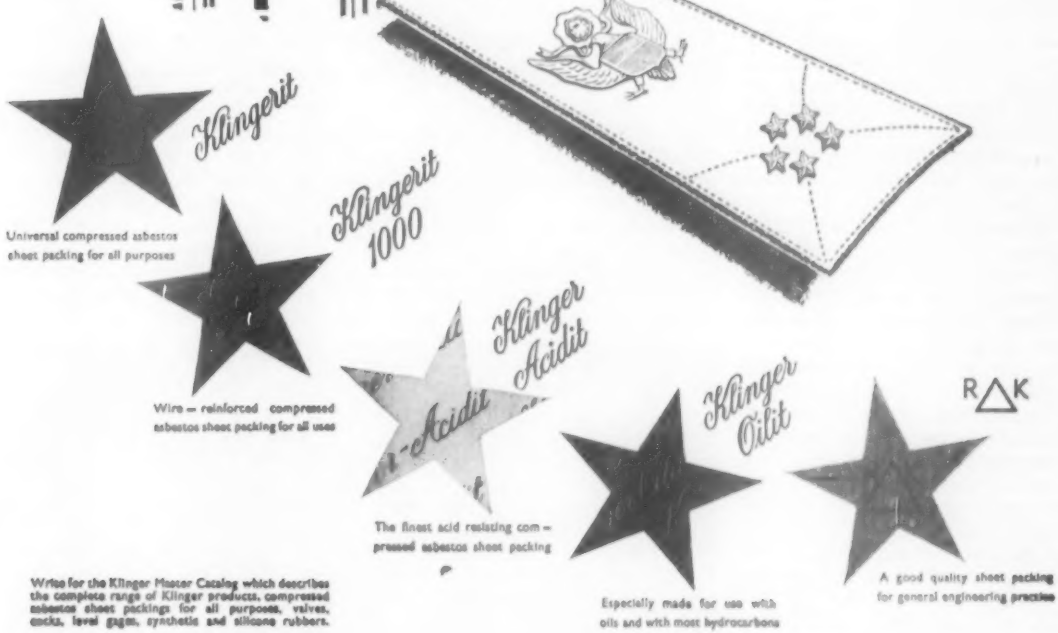

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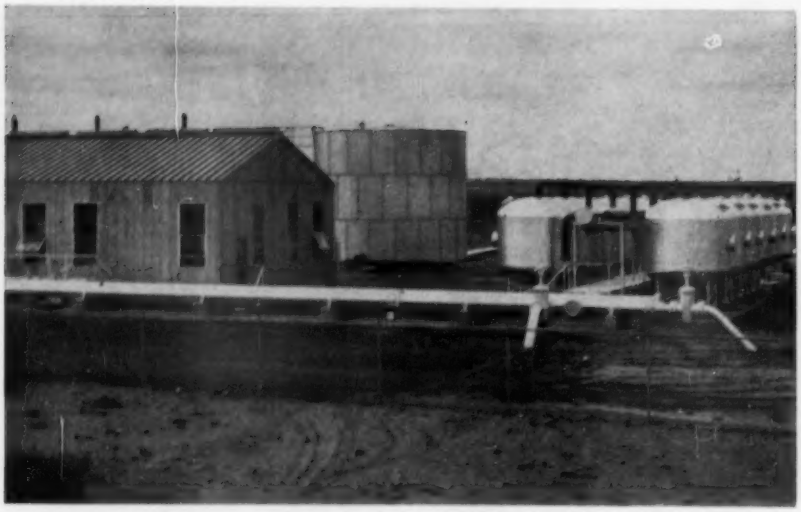


INJECTION WATER is pumped 30 miles from Hendrick field to this injection plant on the western edge of Goldsmith field where it is pumped through high-pressure rapid sand filters (right), into the distribution system, and through . . .

. . . 31 input wells ringing the perimeter of the field's south dome. Water is injected below oil-water contact into the San Andres.

respectively, by Landreth Oil Corp.'s 1 Scharbauer "A" and Gulf's 1 C. A. Goldsmith.

Further drilling by 1937 had established the presence of a large oil reservoir and development proceeded rapidly. This development proved the Goldsmith field structure to trend in a northwest-southeast direction and to have two anticlinal domes separated by a saddle. Each of the crests is topped with a large gas cap.

The oil-saturated section is continuous through the saddle, and the maximum closure is 279 ft. from the oil-water contact to the crest of the structure. The reservoir oil is sour and ranges in gravity from 35° to 38°.

When the first San Andres wells were brought in, reservoir pressure was 1,727 psia. and the solution gas-oil ratio was 757 cu. ft. per barrel. By 1945 reservoir pressure had dropped to 1,461 psia. and the gas-oil ratio had climbed to 1,925 cu. ft. per barrel. Goldsmith operators that year completed an engineering study of the field and recommended that it be unitized and pressure maintenance initiated.

Efforts to unitize the entire field failed, however, and a hearing was held before the Texas Railroad Commission on September 24, 1952, on the application of the south dome operators to unitize and conduct pressure maintenance.

The unit was approved by the commission and became officially effective October 1, 1952.

Bottom-hole pressure at that time had fallen to 1,103 psia. Unit engineers believe that full-scale pressure-maintenance will halt and stabilize the downward trend in pressure at about 1,000 psia.

Pipeline-Tax Drive Seen

Interstate natural-gas carriers may be target of new revenue measures to be submitted to Texas legislature

AUSTIN.—Texas, from all present indications, will take another crack at taxing the long interstate natural-gas pipelines when its fifty-fourth legislature meets early next year.

Various legislative sources have estimated that the state will have to raise between $30,000,000 and $60,000,000 in new revenue to keep up the current spending rate and to pay for an increased outlay for essential services.

Liberal Democratic leaders in the House of Representatives already have come out with proposals to raise any needed new revenue by taxing gas going into long lines.

Leader of the tax drive reportedly will be Rep. D. B. Hardeman, of Denison, Tex., who was instrumental in pushing through a tax on the pipelines in 1951. This tax was fought through the courts for nearly 3 years and eventually was declared unconstitutional last February by the U. S. Supreme Court on grounds that it was a burden on interstate commerce.

The Supreme Court decision caught the Texas Legislature in an awkward position by clipping around $15,000,000 annually off revenues at a time when the legislature was trying to raise money to meet public pressure for a substantial hike in teachers' salaries.

Legislative leaders immediately pressed for a tax on the pipelines that would be constitutional. Various bills providing for a pipeline tax were drawn up. All were eventually discarded in favor of a bill hiking the production tax on natural gas from the old rate of 5.72 per cent to 9 per cent.

The production tax was passed primarily because the legislators figured that any new tax on the gas going into pipelines would be contested in the courts. Whether the tax eventually proved constitutional or not, the revenue resulting from it would be tied up until the case was decided as in the 1951 case. The legislature, needing money, couldn't afford to take that chance.

Time for planning . . . This year the legislature was called into special session to meet the emergency caused by the loss of funds from the 1951 "gas-gathering" tax.

When the fifty-fourth legislature convenes next year, however, the legislators will have had nearly a year to draw careful plans to tax the long lines. Many of them are enraged over so-far successful pipeline company efforts to resist taxation.

Rep. Charles Lieck, Jr., San Antonio, said recently that he is opposed to "taxing the people of Texas until we have exhausted all attempts to raise revenue from the resources leaving the state—such as natural gas. I do not feel that anyone who owns big pipelines in Texas, shipping out our resources, should escape their share of

the load . . . At least an attempt should be made to rewrite the tax law that was declared unconstitutional by the Supreme Court."

Lieck's San Antonio stablemate, Rep. Maury Maverick, Jr., also a liberal, included the long pipelines as a tax target in his proposed "packaged natural-resource tax." This tax also would hit gasoline refiners and sulfur and carbon-black manufacturers.

Minimum gas price? . . . It is also indicated that a third attempt will be made in the coming session to push through a bill giving the Texas Railroad Commission the power to fix the minimum well-head price for Texas gas.

Sen. Wardlow Lane, Center, Tex., said he will introduce the bill again. He was optimistic over his chances of mustering sufficient strength to get it passed this time.

Lane said he believes the commission already has the authority to fix minimum well-head prices but that he will try again to give it specific legislative authorization.

SACROC Battle Dies

Moncrief group which fought Kelly-Snyder unitization sells interest in field to firm operating for S.M.U.

Robert J. Enright

DALLAS.—The long, wearisome struggle over unitization of Kelly-Snyder field in Scurry County ended here last week.

W. A. Moncrief never gave up his long, legal fight against the unitization, but he sold his interest in the huge West Texas field November 29.

Producing properties owned by the Fort Worth oil operator and associates—including Bing Crosby and Bob Hope—were sold for $20,986,000. The purchaser was Ponies Oil Co., which is operated for the benefit of Southern Methodist University.

The properties consist of 422½ oil wells producing from the prolific Canyon Reef pay formation on the east flank of the field.

The wells now will be taken into the unit and operated by the Scurry Area Canyon Reef Operators Committee, formed by a majority of the operators to unitize the 47,429-acre, 1,238-well pool and conduct a field-wide pressure-maintenance program.

The Moncrief group fought a bitter but losing battle for 2½ years against the SACROC pressure-maintenance plan and the unit allocation formula—first in hearings before the Texas Railroad Commission on field rules and injection plans, more recently in a federal suit challenging constitutionality of orders of the commission approving unit agreement and field rules. It is presumed that this suit, which has not yet come up on the docket of the 126th District Court in Austin, will be withdrawn.

Terms of the deal . . . Ponies Oil Co. is putting only $50,000 into the transaction. Remainder of the purchase price will be paid with oil produced from the properties.

Eugene McElvaney, senior vice president of First National Bank of Dallas and treasurer of S.M.U., said there will be two such payments. One of these, totaling $13,273,773.92, is being sold by the Moncrief group to First Dallas Charitable Corp., which plans to borrow the money from an insurance company reported to be Prudential Insurance Co.

The second production payment, $5,936,000, is being sold by the Moncrief group to 20 oil companies participating in the SACROC Unit.

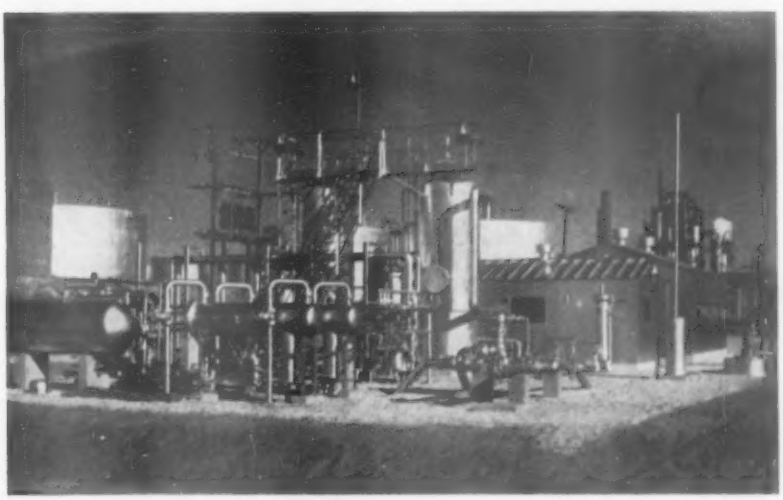
Ponies inherited already-committed production payments of $1,726,226.08 in the deal. Ninety per cent of the oil production will be reserved to meet the production payments, with Ponies meeting expenses out of the remaining 10 per cent. Ponies has assigned an overriding major profit-sharing interest in the holdings to Southern Methodist University. The university, however, will not realize any money from the deal until the production payments have been canceled out in approximately 15 to 20 years.

The Moncrief group has retained an option to purchase from Ponies a 40 per cent interest in the properties after the oil payments are completed. This was arranged through Rainbow Royalty Corp., a new firm set up by the Moncrief group.

The participants . . . Ponies Oil Co. is an unusual concern which came into being after Southern Methodist was presented 30 oil producers in East Texas. The wells were a gift from J. J. Perkins, prominent Wichita Falls, Tex., independent oil man and one of the university's greatest benefactors.

This gift, however, confronted the nontaxable institution, with the problem of conducting a taxable business. Because of this tax angle, S. M. U. prevailed upon Perkins to establish a separate corporation to administer and operate the properties. The East Texas wells were turned over to the new Ponies Oil Co., with S. M. U. retaining an 80 per cent overriding royalty.

The selling Moncrief group is composed of several firms and individuals headed by W. A. Moncrief who, with his sons, W. A. Moncrief, Jr., and R. B. Moncrief, owned 32 per cent of the Kelly-Snyder properties. Other interest holders and their ownership were: Paul



New Products Line Features Dehydration Plant

A key point on the newly completed Wyoming-Nebraska pipeline is this dehydration plant adjacent to the Frontier refinery at Cheyenne. The plant design includes the most advanced engineering techniques, including the use of propane as a heat-carrying agent for regeneration of absorbers. Cheyenne is one terminus of the new 220-mile, 6-in. products line to North Platte. Design and construction was by Gulf Interstate Engineering Co., Houston.

Teas of Dallas, 21 per cent; movie actors Bing Crosby and Bob Hope of Los Angeles, 16 per cent each; Clark & Cowden of Dallas, 8 per cent; Westbrook Oil Corp., Fort Worth, 5 per cent; and Fred Madera, Hobbs, N. M., 2 per cent.

Rainbow Royalty Corp., which has the option to purchase a 40 per cent interest in the production after the oil debts are paid, would operate for the benefit of the grandchildren of Moncrief, the children of Crosby and Hope and other interested parties, and the Mary Couts Burnett Trust of Fort Worth.

Why the dispute . . . The pressure-maintenance program just recently placed in full-scale operation by SACROC *(The Oil and Gas Journal, October 25, page 79)* consists of a line-type water flood with injection wells down the crest of a ridge in the Canyon Reef formation, together with gas injection in the north end of the field.

It was fought every inch of the way by the Moncrief group, which proposed gas injection along the crest of the structure and water injection around the edge of the field below the oil-water contact.

The Moncrief interests contended that the SACROC program was not patterned after accepted conservation practices and was dangerous because several years might elapse before its effects were fully felt. The 73,000,000 bbl. or more of water which would be injected into the producing formation each year, they argued, would cause irreparable damage to the field's best wells including those of the Moncrief group.

Moncrief also objected strongly to the allocation formula set up by the unit and to the provisions for bonus allowables based on the amount of water injected.

Under the unit allocation formula, the Moncrief group's share of the field's production would have been 2.53 per cent. Production of the properties while negotiations were going on, however, was approximately 4.6 per cent of the field's oil output. The Moncrief group's profit from its holdings thus would have been cut almost in half initially under unit operation. SACROC engineers, however, contended that the properties would produce a great deal more oil over the long pull if participating in the unit.

Despite Moncrief arguments against injection plan and bonus allowable, most observers felt that the cut in immediate profits from the Moncrief properties was the primary cause of the commotion.

The SACROC unit was approved by the Railroad Commission over vigorous opposition from the Moncrief group on January 30, 1953. The unit became effective March 1, but actual water flooding could not begin until field rules were approved by the commission.

The hassle over field rules lasted until January 18 of this year when the commission approved in the main the set of rules set up by SACROC. Moncrief immediately filed for a rehearing of the decision, which was denied by the commission.

The fight was then carried to the federal court in Austin. Moncrief charged that the Railroad Commission refused to examine or pass on the fairness of the terms of the unit agreement and permitted SACROC to increase its share of the field production early in the primary life of the field at the expense of his group and others.

The commission orders, the suit said, were entered without any evidence that nonsigners were protected or as to how the unit and pressure-maintenance program would actually operate.

The sale to Ponies Oil, of course, makes a decision in the case appear unimportant.

Gasoline Plant Started

SAN ANGELO, Tex.—Construction has been started by Texas Natural Gasoline Corp. on a new natural-gasoline plant to serve Jameson Strawn Sand field and Fuller Coke Strawn field in northwestern Coke County.

The plant will have a capacity of 70,000,000 cu. ft. daily. It will process casing-head gas now being flared. A company announcement said the residue gas will either be sold to a transmission company or returned to the reservoir in a pressure-maintenance program.

Texas Natural has gas-purchase contracts covering more than 15,000 acres which, when fully developed under the existing 40-acre spacing program, will contain between 375 and 400 Strawn wells.

The gathering system and compressor plant is expected to be in operation by March 1, with the fractionating unit in operation by August 1. At capacity operation, production will be in excess of 800,000 gal. daily.

Sun To Build New Research Lab

DALLAS.—Sun Oil Co. will start construction early this month on a new $400,000 production research and development laboratory on a 14½-acre tract at Richardson, about 10 miles north of here.

Tom F. Hill, assistant manager of Sun's division office in Dallas, said last week the new lab will have about 20,000 sq. ft. of floor space. It will replace Sun's present laboratory in the Oak Cliff area of Dallas and double the 10,000 sq. ft. of floor space available in that building.

In addition to the laboratory building itself, Sun will erect a service building on the site enclosing 10,000 sq. ft.

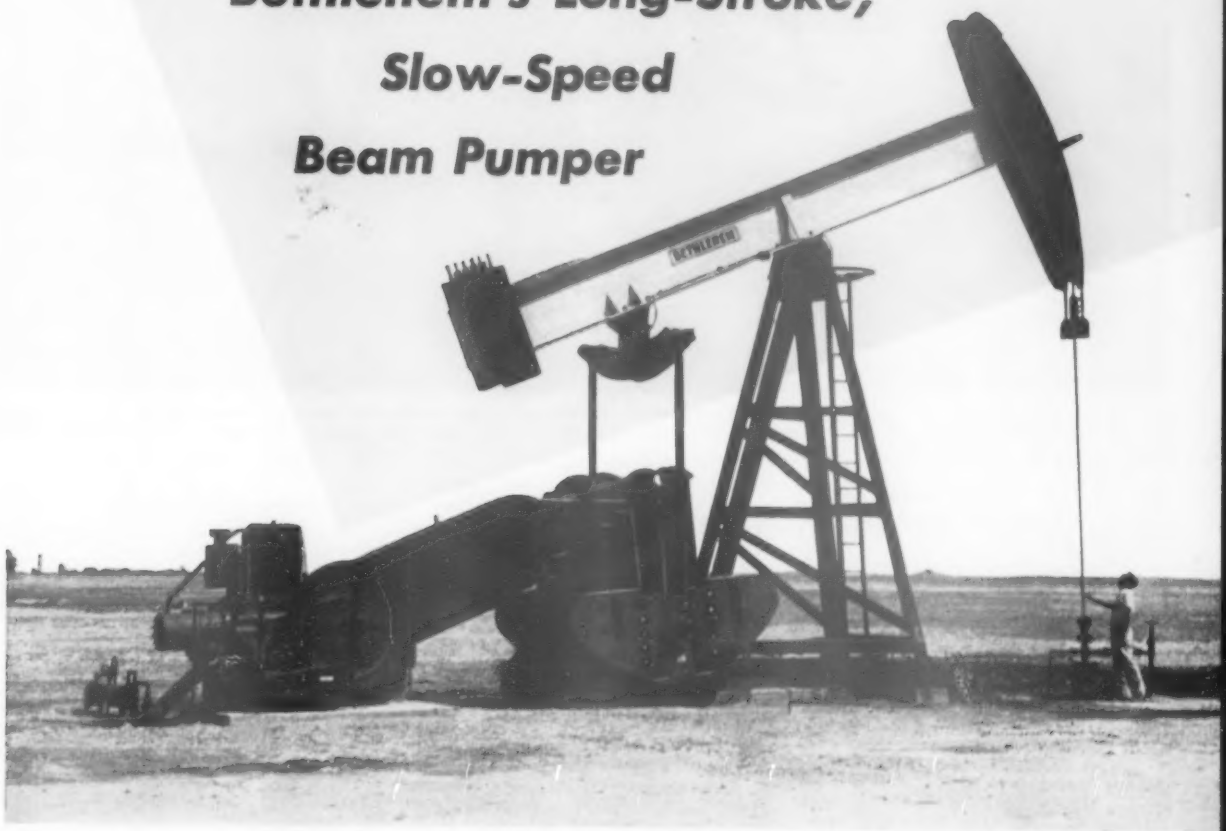
The new research building will be built in the shape of a letter "E," while the service building will be rectangular. Both will be one-story, steel-frame and masonry structures.

The new facilities will be completed and occupied by about the first of July next year.

Sun is one of three major oil firms with research labs in the Dallas area. Magnolia Petroleum Co. operates a field research plant concentrating on geological, drilling, production, and development problems southwest of the city and a geophysical lab in Northwest Dallas. Atlantic Refining Co. has a large exploration-production research lab also in the northwestern part of the city.

For the Deep-Well Job...

Bethlehem's Long-Stroke, Slow-Speed Beam Pumper



Is yours a deep-well job where economy dictates a long-stroke, slow-speed pumping unit? If so, Bethlehem's 16-ft-stroke pumper can be the answer.

It's a unit with 640,000 in.-lb torque at 20 spm; 726,000 in.-lb at 6 spm; 743,000 in.-lb at 4 spm—a unit that gives excellent dynamometer-card characteristics and smooth, reliable performance during long-term operations.

With a properly-matched bottom-hole pump and rod string, this big fellow is suitable for depths of almost two miles. But remember, too, that Bethlehem makes a full line of units, ranging from the long-stroke giants on the top side to a small pumper with 20-in. stroke and 10,000 in.-lb torque. From this line it is always possible to select a unit that will meet your problem . . . whether deep-well production when flowing stops, or shallow pumping and secondary recovery.

Full details are available from any Bethlehem engineer. Call or write our nearest office.

In addition to pumping units and all items of drilling equipment, Bethlehem offers Beth-Co-Weld line pipe, Purple Strand wire rope, and a complete variety of sucker rods, fasteners, etc. Ask for these products when equipping your oil-country installations.

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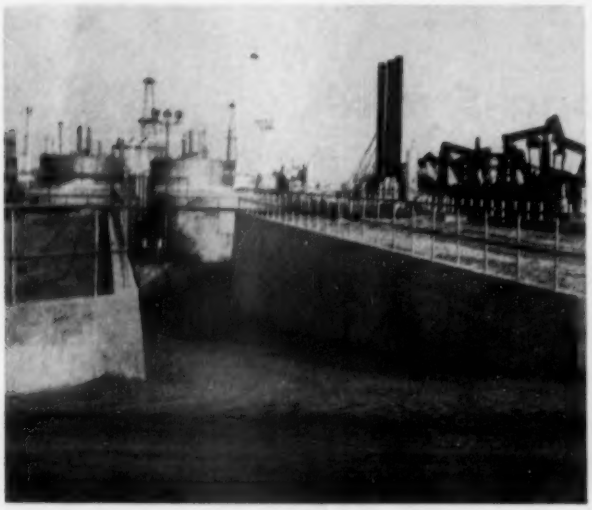


ELEVATED approximately 18 ft. above their former level, these Pier D pumping units at Long Beach now tower above decks of nearby tank battery. Tanks are not being raised.

WELLS in the once-sunken area await reinstallation of pumps after fill-in work. Dirt-moving project will restore surface of harbor field, which has sunk as much as 20 ft.

Long Beach sinking millions in . . .

. . . Leveling Sunken Oil Field

D. H. Stormont

LONG BEACH.—The city of Long Beach is literally moving mountains of dirt in its efforts to overcome land sinking in the harbor area of the Wilmington field.

It is estimated that more than 15,000,000 cu. yd. of dirt will have been piled on the existing surface when the project is completed about 10 years hence. Almost half this amount was moved during the 3 years the face-lifting project has been under way.

This expensive undertaking, expected to cost about $34,000,000, is causing city officials to move slowly in permitting development of portions of the field which underlie the business sector. Oil-producing activities are not the sole cause, but studies have shown a close relationship between degree of subsidence and amount of fluid withdrawals.

Measurements made since the subsidence studies were initiated indicate a bowl-shaped area nearly 10 miles long and 5 miles wide. At the center, which coincides with portions of the field that have been depleted the most, a drop of about 20 ft. has occurred. At the edges of the bowl, the drop has been only a foot or so.

If studies made by university and oil-company engineers are correct, maximum drop due to oil-producing activities will be about 28 ft. at the center of the bowl.

The fill being made, to an average depth of 13 ft. for the 760-acre harbor area, not only will overcome subsidence which has occurred but also that which is anticipated. In so doing, the city is protecting property which has yielded it more than $200,000,000 and is continuing to give a monthly income of about $2,400,000.

Pier area . . . One of the largest earth-moving jobs was in elevating 167-acre Pier E. This required 4,500,000 cu. yd. of fill, dredged from the ocean and moved to the area by hydraulic lift. Prior to the fill, portions of the area, which is near the center of the subsidence bowl, were below sea level during periods of high tide. Also involved was the elevation of about 150 producers to the new surface level. All oil, gas, and water lines were relaid.

Work on Pier D, where the surface was raised as much as 18 ft. is almost completed. More than 100 wells have been restored to production at the new elevation.

Only a few oil wells are on the Piers B and C so that the average 10-ft. fill being carried out is not greatly hampering oil activities. Most portions of Pier A, which contain the largest number of city wells, are relatively new and unaffected by subsidence. Harbor engineers estimate, however, that more than 3,000,000 cu. yd. of dirt will be moved onto the 225-acre area.

The harbor area lying between the piers and Seaside Boulevard is to be elevated an average of 15 ft. This work, to begin next year, will affect some 50 producers. An added job will be the elevation of Harbor Department headquarters by some 10 ft.

Townlot area . . . Second phase of the project will involve the townlot area lying north of Seaside Boulevard. This 127-acre area, containing about 100 privately owned oil wells, must be raised an average of 18 ft. More than 3,700,000 cu. yd. of fill will be required in this $11,000,000 project. Work will not start for several years, however. The city first must obtain title through condemnation proceedings.

Repressuring program . . . In addition to these earth-moving activities, the Harbor Department is sponsoring trial projects to determine if subsidence can be retarded by repressuring. Both gas and water injection are being conducted by the city's two contractors, Long

THIS PORTION of the harbor area around Long Beach Harbor Commission headquarters is to be raised about 10 ft., or to the height of dikes now needed to protect against ocean spray.

Beach Oil Development Co. and Richfield Oil Corp.

These have not been under way sufficiently long for their worth to be determined, either as a cure for subsidence or for increasing ultimate oil recoveries. It is expected, however, that when the city council grants any new development contracts or permits any drilling under downtown Long Beach, pressure maintenance will be required from the beginning. The general feeling is that too much is at stake to do otherwise.

Fuel-Oil Outlook Poor

Coast refiners are plagued again with oversupply; they're working on the problem, but the future is far from bright

LOS ANGELES.—West Coast refiners are suffering another attack of their chronic ailment—bulging stocks of residual fuels.

Inventories are so high that refiners are sending a steady stream of fuel oil to the Atlantic Seaboard, at a rate of about 13,000 bbl. daily. The age-old problem is basically due to the great amount of heavy crude produced in California, but the present oversupply of heavy fuel persists in spite of the fact that 15,000 bbl. daily of low-gravity production has been shut in.

Continued warm weather in the western states tends to make the situation even more acute. During the first half of November, for example, supply was outstrippng demand by about 30,000 bbl. daily.

The East Coast movement is not expected to approach levels attained in the year which ended in October 1950, when movements hit nearly 60,000 bbl. daily. On the other hand it indicates the seriousness of the oversupply.

The problem . . . Residual inventories currently total about 31,000,000 bbl., plus an additional 17,000,000 bbl. held as cracking stocks. Cracking stocks are up a little from a year ago, but fuel-oil stocks are 10,000,000 bbl. higher. They totaled slightly over 40,000,000 bbl. in late 1949 when the not particularly profitable movement to the East Coast reached major proportions.

The current surplus is partly the result of slackened demand. Another factor is the mounting imports of natural gas from Texas and New Mexico fields. These pile up residual stocks by capturing some of the fuel-oil markets. Light foreign crudes are aiding some California refiners in meeting their light product demand but the resulting heavy ends must be disposed of.

Demand for residual oils was 348,000 bbl. daily during the first 9 months of the year, according to Bureau of Mines figures. This was 20,000 bbl. less than in the same period of 1953.

A 11,000-bbl. drop was registered in railroad use. Ship bunkering was down 7,000 bbl. daily. Greatest drop, about 16,000 bbl., was in power generation. On the plus side a 7,000-bbl. increase was shown in oil-company use. Another principal gain was in military demand, up 5,000 bbl. daily.

No quick cure . . . The oversupply situation of 4 years ago was solved relatively quickly.

There is little promise for such a quick cure now in the opinion of most West Coast market students.

They expect heavy fuels, and low-gravity crude, to be a problem as long as there is an inherent shortage of high-gravity crudes in California—or until California refineries are modernized to the extent that less heavy material is produced in refining from a barrel of crude.

Demand for petroleum products in the five western states is continuing to show an increase of about 5 per cent annually. The gain, however, is not being met with California crudes and refined products. The trend is for the Pacific Northwest, which has a current demand of about 300,000 bbl. daily, to obtain more and more of its crudes and products from Canada and Rocky Mountain oil states.

Some of this market, historically supplied by California refineries, already has been lost to the new sources. About 60,000 bbl. of light products, up 20,000 bbl. over a year ago, are being transported into the Spokane-Tacoma region by pipelines from Rocky Mountain refineries.

Refineries in the Vancouver, B. C., region are processing about 50,000 bbl. of Alberta crudes daily. General Petroleum Corp. is starting up its 35,000-bbl. Ferndale, Wash., refinery this month. It will process 15,000-bbl. daily of Alberta crudes, piped to the plant through an extension of the Trans Mountain Oil Pipe Line Co. line from Edmonton to Vancouver.

The probability of natural gas being transported into the Pacific Northwest from the San Juan basin and from Canada's Peace River area poses a particular threat to fuel-oil demand. Fuel-oil consumers in that region have been getting relatively cheap supplies, only some 30 cents per barrel above the Los Angeles refinery price.

Still larger imports of Texas gas into the Los Angeles and San Francisco areas are set for next year. These are expected to result in its greater use, in preference to fuel oil, by the electric utility companies and large industrial users.

Oregon Test Prepared

VALE, Ore.—El Paso Natural Gas Co. is preparing to start a 6,500-ft. Jurassic test in Malhuer County, Oregon, 15 miles west of the Idaho border. The test will be 1 Federal, on a farmout from Sinclair Oil & Gas Co. Location is about 10 miles south of here, in 5-20s-44e.

Drilling Tender Launched

Vessel will be used in exploratory work off the coast of Louisiana as four-company group expands operations

ORANGE, Tex.—Another $1,500,000 tailor-made drilling tender was launched here last week by the CATC Group as the four-company combine prepared to speed up oil exploration on its vast holdings in the Gulf of Mexico.

The new ship, the Carle Sharp, will soon join its sister vessel, the J. C. Craig, in drilling operatons off the Louisiana coast.

One of the first combines in which assets were pooled to finance exploration in the Gulf of Mexico, the aggressive CATC Group is proving one of the most successful operators offshore. It is composed of Continental Oil Co., Atlantic Refining Co., Tide Water Associated Oil Co., and Cities Service Oil Co.

Since its organization in July 1946, the group:

. . . **Completed extensive** seismograph work off the Louisiana coast over a 3-year period.

. . . **Spudded in** its first well in March 1952 in Louisiana's West Bay, 5 miles off Plaquemines Parish, which resulted in discovery of West Delta field.

. . . **Drilled nine wells** in the field, which is now producing an average of 1,500 to 2,000 bbl. of oil daily under current allowables.

. . . **Drilled six gas wells** which are now shut in. Two are in West Delta, one in newly discovered East Cameron Block 71 field, and three in West Cameron Block 192 field, 35 miles from shore of Cameron Parish—the greatest distance oil men have ventured from land to date.

. . . **Drilled only four dry holes** out of a total of 19 wells completed to date.

Large holdings . . . Each of the four participating companies has a 25 per cent interest in the group's operation. They together hold large blocks of tidelands acreage off both Louisiana and Texas, including 25,000 producing acres off Louisiana and 399,000 undeveloped acres off Louisiana and Texas.

The group and the individual companies involved increased their holdings of federal leases at both of the recent sales for Louisiana and Texas Continental Shelf acreage, paying unusually high prices for certain tracts.

Platform being installed . . . Conoco, group operator, reports that the group's new $1,500,000 self-contained drilling platform, now being fabricated in a New Orleans shipyard, should be ready for transporting to location off Grand Isle, in West Delta field, about the middle of December. This will be one of the largest self-contained platforms ever constructed, and it will stand in 97 ft. of water—deepest yet for offshore drilling operations.

Tender features . . . The tender ship Sharp, like the J. C. Craig, first tailor-made nonself-propelled vessel to slide down the ways for the CATC Group, will not be used in the current West Delta deep - water - platform operation, however. They will operate with smaller template platforms in shallower water, although one of their features is their ability to operate in 100 ft. of water if necessary.

The newest vessel (another just like it is being rushed to completion at the Levingston Shipyards here) is 260 ft. long and 54 ft. wide. It has quarters for 50 men, and it can store 13,000 bbl. of drilling water, 1,260 bbl. of fresh water, 312 bbl. of potable water, 1,538 bbl. of drilling mud in the reserve pits plus 554 bbl. in the active pits, 1,000 sacks of dry mud, 1,100 sacks of cement, and 804 bbl. of fuel oil. The vessel was named after the manager of Atlantic's domestic producing department.

Like the J. C. Craig which is now operating off the Louisiana coast, the Sharp will be towed to location by tugs.

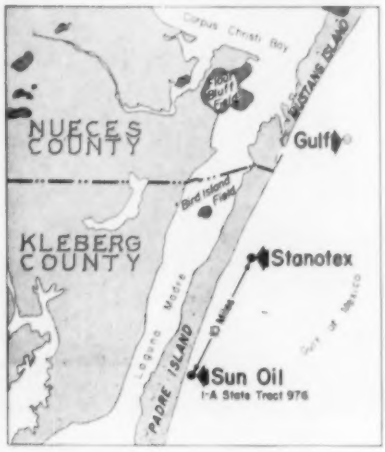
Sun Hits Offshore

Gas discovery gives Texas its second tidelands field

CORPUS CHRISTI.—A gas discovery well has been completed in the Gulf of Mexico off the coast of Padre Island, Kleberg County, Texas, 30 miles south of here by Sun Oil Co.

It opens Texas' second tidelands field. The well is 10 miles south of the first field, discovered by Standard Oil Co. of Texas in July.

Sun's discovery well, 1-A State Tract 976, is rated good for 9,300,000 cu. ft. of gas daily on open flow. With flow



restricted to 11/32-in. choke, it produced at the rate of 5,000,000 cu. ft. of gas per day with pressure of 1,925 psi.

Production is from casing-perforated interval at 9,112-38 ft. in Frio sand.

The well is bottomed ¾ mile offshore and was drilled directionally from surface location 4,460-ft. to the west on Padre Island. Total depth is 9,238 ft. (drilled), and 7,903 ft. (vertical). Another test, with bottom location about ¾ mile north, is being started.

The offshore well follows the drilling of four dry holes on that area of Padre Island in the past year.

Discovery well of Standard Oil Co. of Texas' new tidelands field, 10 miles to the north, was completed as an oil producer from Frio sand at 7,760-66 ft. Potential gage was 254 bbl. of 40°-gravity oil per day through 5/32-in. choke.

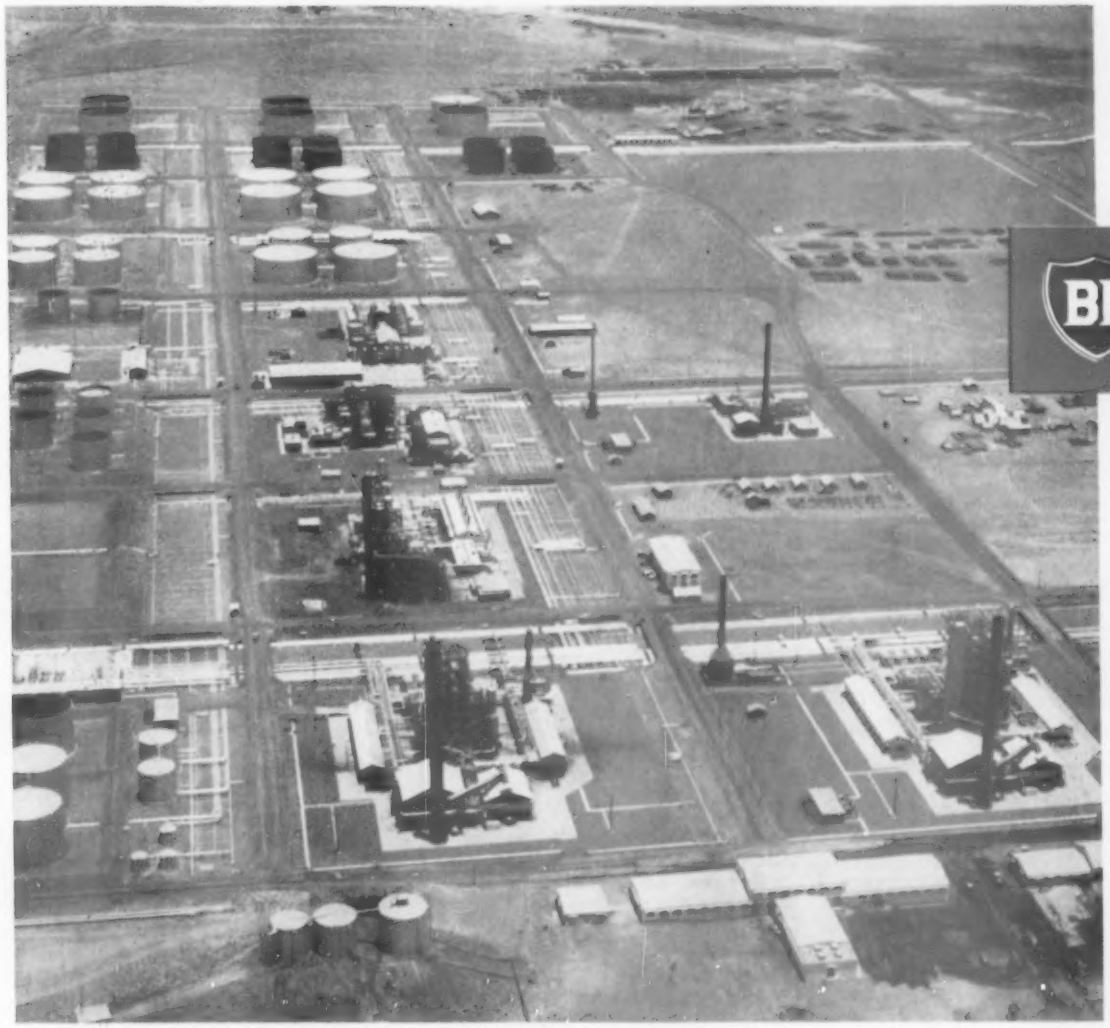
Zapata Goes To Sea

New company to start drilling in Gulf of Mexico

MIDLAND, Tex.—Another new firm, Zapata Off-Shore Co., has been formed here to join the swelling list of companies scrapping for a share of the booming drilling business in the Gulf of Mexico.

Zapata Off-Shore, an affiliate of Zapata Petroleum Corp. will drill on its own account in the gulf as well as engage in contract drilling for other organizations.

The new firm already has ordered a new $3,000,000 mobile drilling platform from R. G. LeTourneau, Inc. The platform, which is being assembled at LeTourneau's Vicksburg, Miss., plant, is reported capable of drilling in water



The Aden Petroleum Refinery of Anglo-Iranian Oil Company, Limited

21 ACTIVE MONTHS

Less than 21 months after the first party of constructors arrived at jobsite, the great new Aden Petroleum Refinery was in operation.

In that short period a large diversified oil processing plant with staff housing and utilities was built at a remote location and brought into production substantially ahead of schedule. George Wimpey & Co., Limited, was an associate on the Aden project.

The ability to provide an integrated service—design, engineering, procurement and construction—had an important bearing on results. This service, in whole or part, is available when and wherever needed.

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80 ft. deep and will be equipped with a heavy rotary rig in the 16,000-ft. class *(The Oil and Gas Journal, September 20, page 145).*

Company officers . . . President of the company will be George Bush, Midland, a vice president and director of Zapata Petroleum, according to Hugh Liedtke, president of the parent firm. Offices will be maintained in both Midland and Houston.

Wayne H. Dean, former manager of drilling for Kerr-McGee Oil Industries, Inc., Oklahoma City, has been elected vice president of the company in charge of the Houston office and of Gulf Coast operations.

Hoyt S. Taylor has been named chief engineer for the firm at Houston. Taylor was with Kerr-McGee as Gulf Coast division drilling engineer. In that position, he coordinated construction of Kerr-McGee's new mobile drilling platform, Kermac 44.

Before becoming drilling manager for Kerr-McGee, Dean served 5 years as director of the firm's offshore drilling operations. He was employed as a drilling superintendent by The California Co. before joining Kerr-McGee.

Lake Arthur Active

Extensions, new deep sands step up drilling program

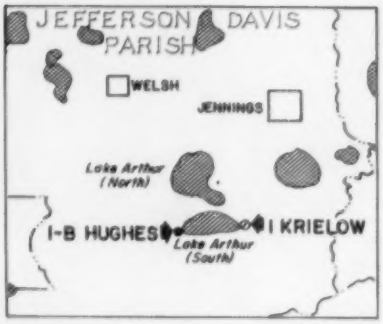
JENNINGS, La. — Important extensions and the discovery of additional deep, prolific gas-condensate sands over a sizable area have stepped up the drilling and development program in the Lake Arthur area, 7 miles southwest of here.

Union Sulphur & Oil Corp., Houston, has moved two additional heavy-duty rigs into southeastern Jefferson Davis Parish to augment the pair which has been operating in the area. Three new locations were reported last week.

Last week the company also completed another large gas-condensate well in the new southwest extension area of South Lake Arthur portion of the field. It was the sixth consecutive well completed in developing deep Frio-Camerina sand zones.

These zones already have been found productive over an undefined area 3 miles long, extending from the extreme southeast to the extreme southwest sides of the field. They are only one group of multiple sands found productive in the Lake Arthur area.

The new well . . . The 1-B Hughes has 188 ft. of net gas-condensate pay in the lower Camerina sand zones, topped at 12,315 ft. and bottomed at 12,705 ft. Tests developed flowing pressures



in excess of 6,000 psi. and recorded bottom-hole pressures of 10,000 psi. The well, drilled to 13,473 ft., has more than 240 ft. of producing sand thickness including the lower Camerina. It is structurally the highest well in the field.

Others . . . Now drilling below 13,450 ft. is a prospective extension more than 6,100 ft. to the northwest of the new Hughes well. Other new development includes 2-B Hughes, 660 ft. north of 1-B; 1 Bertrand, a 3,000-ft. outpost to the southwest; and 1 Krielow, a 3,000-ft. stepout on the southwest side of the field. Location has also been made for 1 Van Geffen, another 3,000-ft. outpost on the east side.

Lake Arthur field . . . The field, including the north and south areas, is becoming one of the larger and more prolific gas-condensate fields on the Louisiana Gulf Coast.

Discovered by Union Sulphur in 1937, the north area has also been the scene of comparatively recent important extensions and new pay discoveries in Marginulina Texana sands below 10,700 ft., and now has 19 producing wells.

The more recently developed south area has six wells. Union's lease block, encompassing both areas, totals 21,600 acres. Current daily production is more than 1,200 bbl. of crude and condensate and 54,000 M.c.f. of gas.

Mr. Gus Gets Helicopter Help

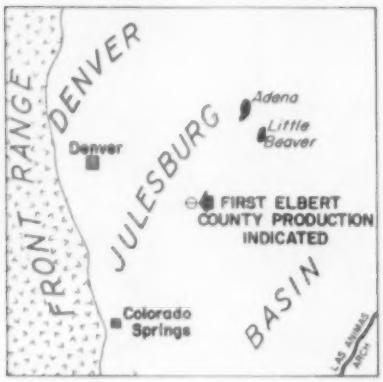
FREEPORT, Tex.—Mr. Gus, the big mobile drilling barge that settled on location off the coast of Texas recently, keeps in contact with onshore operations partly through the efforts of chartered helicopter service—a service that is growing with Gulf Coast oil operations.

The whirlybird serving Mr. Gus is one of two operated by Hawk Helicopters, Corpus Christi. The other plane is chartered by Western Natural Gas Co. for its drilling operations 9 miles off the coast from Palacious, Tex.

George Hawn is president of the Corpus Christi helicopter firm. His two brothers, John and William, are vice president and secretary-treasurer, respectively.

Mr. Gus spudded its first well for Shell Oil Co. late last month in Tract 249, 5 miles from San Luis pass. The barge is owned by the C. G. Glasscock Drilling Co.

Several other helicopters are employed in Gulf Coast offshore operations on a charter basis. Magnolia Petroleum Co. became the first major oil company to operate its own helicopter when it placed a 47G Bell in service early last month. The Magnolia plane is the same model used by Hawk Helicopters.



Discovery Indicated

Well could give Colorado another producing county

DENVER.—A new producing county for the Denver-Julesburg basin seems apparent at Sinclair Oil & Gas Co.'s Elbert County wildcat, 1 Bradbury, 30 miles southwest of nearest important production at Little Beaver-Badger Creek field.

Recovery on a drill-stem test at 7,167-7,202 ft. was 920 ft. of oil from the Dakota J sand. The crude is 33° gravity. Sinclair is preparing to run casing.

Elbert County has had scattered previous exploration, but with no success. The new discovery prospect is in line with the general trend of fields through the basin. The county and adjoining areas have shown an increase in leasing interest recently and success at the Sinclair wildcat would spur drilling activity. The firm has a second well under way at 1 Johnson, NW NW NW 26-6s-60w.

Washington hit . . . Northeast of Elbert County, Kimbark Co. and Sterling Drilling Co. have an apparent J sand discovery at 1 Porter, C SW SW 30-2s-55w, Washington County.

Recovery was 1,290 ft. of oil and 4,600 ft. of gas on a drill-stem test at 4,987-92 ft. The new strike is 9 miles east of Badger Creek production and northeast of Big Beaver field. The new pool is designated Plum Bush Creek.

Merger Move Made

DENVER.—Inland Oil & Uranium Corp., Denver, has obtained control of Morton Oil Co. by acquiring 1,700,000 of the 3,000,000 outstanding shares of Morton stock.

Remaining stockholders of Morton are expected to be asked to ratify a merger with Inland through exchange of their stock for Inland stock.

E. M. Stone, president of Inland and of Empire Petroleum Co., has succeeded James R. Macon as president of Morton.

Pipeline May Change Hands

CHEYENNE, Wyo. — The Continental Pipeline Co., wholly-owned subsidiary of Continental Oil Co., has applied to the Wyoming Public Service Commission for authority to acquire and operate properties of Rocky Mountain Pipeline Co.

Continental Pipeline owns 45 per cent of outstanding Rocky Mountain Pipeline stock. It hopes to acquire the other 55 per cent, which is held by Continental Oil Co. The pipeline subsidiary then would dissolve Rocky Mountain Pipeline and take over its properties.

Rocky Mountain Pipeline owns and operates a crude-oil pipeline from Lance Creek field in Niobrara County, Wyoming, to the Wyoming-Colorado state line.

"D" Sand Output Limited

DENVER.—The Colorado Oil and Gas Conservation Commission has placed a limit on the production of oil and gas from the "D" sand of Masters field in Weld and Morgan counties.

A commission order restricts monthly production from any one well to an average of not more than 125 bbl. of oil daily and not more than 150,000 cu. ft. of gas daily.

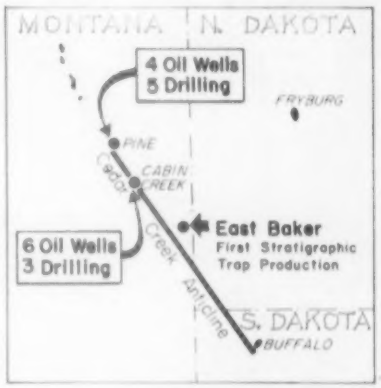
The commission said present production is "unreasonably diminishing the quantity of oil or gas that might ultimately be produced."

El Paso Plans Revealed

SALT LAKE CITY.—A stepped-up exploration program in Utah and western Colorado is planned in 1955 by El Paso Natural Gas Co.

According to information filed with the United States Geological Survey, El Paso Natural plans two wells in Peters Point gas field, Carbon County, Utah; one well in Twin Buttes gas field in Rio Blanco and Garfield counties, Colo.; and one wildcat at the Jack's Canyon unit in Carbon-Uintah counties, Utah.

If the two Peters Point wells are successful, several other wells will probably be drilled next year.



Montana Well Hits

Monoco makes significant strike in East Baker area

BAKER, Mont.—Another significant oil strike was reported last week in the East Baker area 7 miles east of here.

Monoco Oil Co. reported an initial pump and flow rate of 495 bbl. of oil per day, based on a 5-hour test, at its 1 Ferguson-Goldin. The well promises the first production from a stratigraphic trap in the area east of the Cedar Creek anticline in the Williston basin.

Production is from the Red River-Ordovician at 9,246-84 ft. Two more locations have been staked in the area by Monoco, and McAlester Fuel Co. is drilling a southeast offset to the discovery.

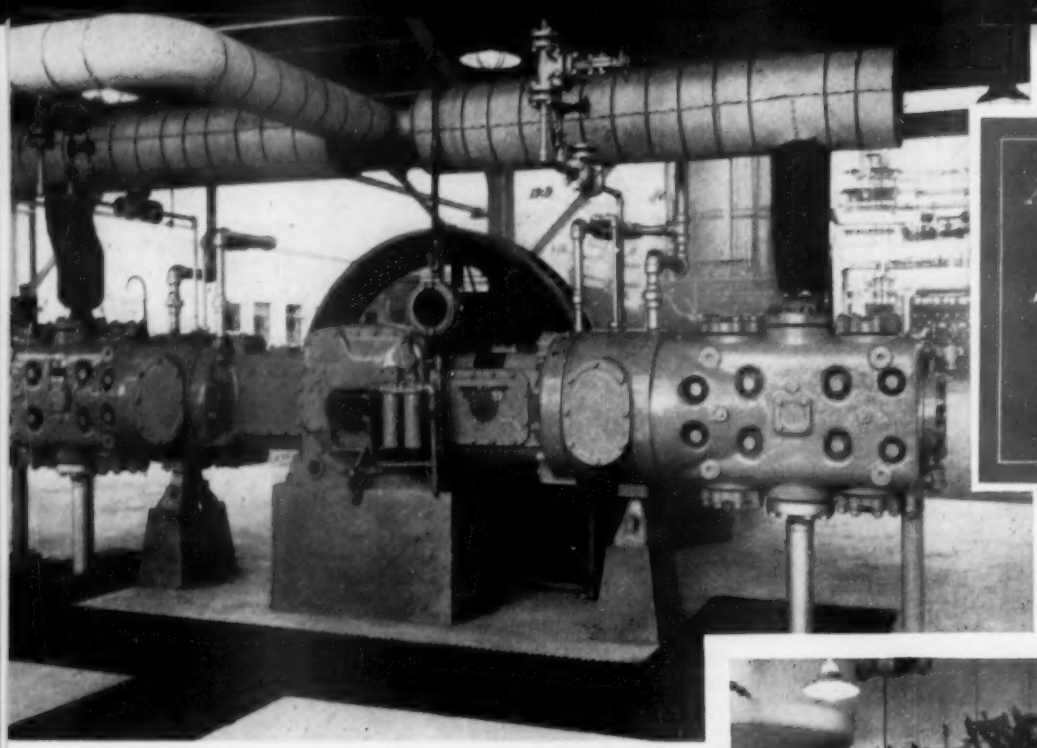
The Cedar Creek anticline has been the center of important oil developments in Montana this year. Most of the development drilling has been in Pine and Cabin Creek fields. Pine has had four wells this year and Cabin Creek six.

Shell Oil Co., which drilled the four wells at Pine, has four more wells under way there, while Stanolind Oil & Gas Co. reports one well nearing total depth.

Development of the area has been relatively slow because of acute pipeline shortages.

Pine field, now with a total of 11 wells, has been extended north-south 6½ miles. It has both Ordovician and Silurian production, and completion tests have ranged from 148 to 431 bbl. daily.

Cabin Creek field has seven Ordovician producers, although the Silurian also is productive there. The six wells completed this year all were drilled by Shell.

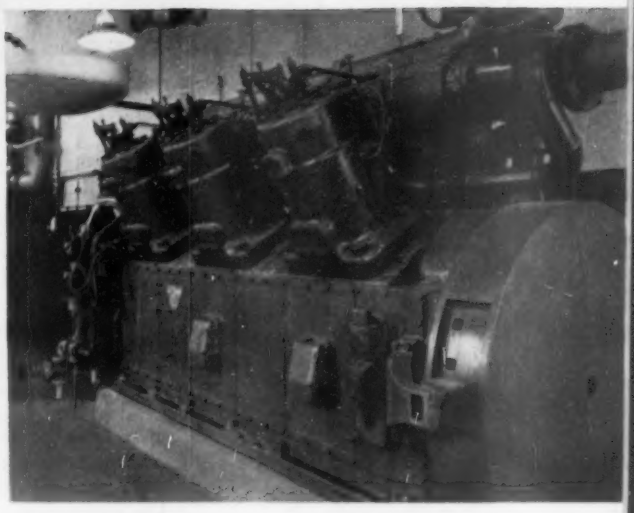


Another Example of Efficient Power at Lower Cost

One of the two Cooper-Bessemer EM compressors, rated at 300 hp, serving in Canadian Oil's UOP Platforming operation. Note the simple, neat and compact arrangement of this "open air" unit.

EM's and GMX's at Sarnia . . .

NEW HIGH'S IN COMPRESSOR EFFICIENCY for higher octane gasoline



Two 6-cylinder Cooper-Bessemer GMX compressors, rated at 330 hp at 400 rpm, being installed to recirculate gas for the Houdriformer process at Sun Oil Company's new Sarnia, Ontario plant.

COOPER-BESSEMER 2-cylinder EM's and 6-cylinder GMX's — offer efficient compressor service for two different oil companies employing different processes at Sarnia, Ontario.

At the Sarnia refinery of Canadian Oil Refineries, Ltd., two motor-driven EM compressors recycle hydrogen for their new UOP Platforming unit. This unit, charging nearly 3800 barrels per stream day, produces high yields of gasoline with an octane number reaching well into the 90's. Equipped with non-lubricated cylinders, EM's play a vital and dependable role in this production of high octane gasoline.

And, for the new Houdriformer of a similar capacity at Sun Oil Company's Sarnia plant, two Cooper-Bessemer GMX V-Angles, also with non-lubricated hydrogen cylinders, are used in the recirculation of gases. This catalytic reforming unit likewise upgrades low octane naphthas to high quality motor fuels.

Whether you are considering UOP Platforming, a Houdriformer, or other operations requiring compressors of virtually any type, — Cooper-Bessemer offers more than a century of reliable compressor building experience. Contact your nearest office for detailed information.

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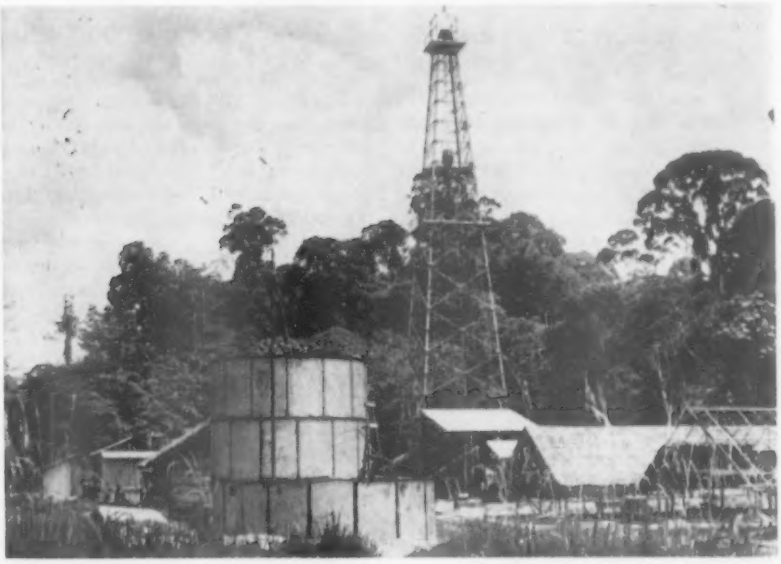


MODERN DERRICK overshadows crude thatch huts in British Borneo. British Malayan Petroleum Co. (Royal Dutch-Shell) is continuing to explore this field, already the most productive in the Far East. The company recently has erected modern concrete houses for its employes.

Feud with sea rages in . . .

. . . Borneo's Quest for Oil

THE China Sea is being assaulted from two sides as British Malayan Petroleum Co. steps up its program for development of oil resources in British Borneo. One project involves offshore drilling in search of new production, and the other will provide a sea wall to protect current production along the shore.

British Malayan, a member of the Royal Dutch-Shell Group, is building a 6-mile-long wall to prevent the China Sea from encroaching on the flat Seria field in the Sultanate of Brunei, a British-protected state. The field, discovered in 1929, has been developed rapidly since World War II and is now producing approximately 100,000 bbl. of oil daily, making it the most productive in the Far East.

Prewar development of the field was largely confined to the shallow heavy-oil zones at 1,000 to 3,000 ft., although there was some production of light oil from depths of 4,000 to 7,000 ft. Production increased from about 17,000 bbl. per day in 1940 to 102,000 bbl. per day in 1951, largely as result of rapid development of the light-oil reserves.

The postwar drilling program has fairly well defined the field on land, although two deep tests in the central part of the field during the past 2 years encountered oil and gas at extremely high pressures below the previous limits of production.

Offshore operations . . . British Malayan is now concentrating on delineation and development of the extension of the pay structure beneath the China Sea. More than half of the wells drilled there during the past 2 years have been deviated to undersea objectives.

To extend exploration seaward beyond the reach of directional wells drilled from shore, the company is erecting a series of drilling platforms about a mile seaward. The first of the platforms has been in operation the past 2 years, and the first well from another platform is to be spudded by the end of 1954. A third platform will be completed early in 1955.

Four wells can be drilled from each platform. An aerial ropeway is used to convey crews and materials from the shore since frequent storms, for which the China Sea is notorious, make it difficult to maintain reliable boat service. *(The Oil and Gas Journal, November 1, page 76).*

Structurally, Seria field is a faulted anticline, the axis of which runs parallel to the shore a short distance out to sea. Oil is produced from at least 30 separate zones, in a matine sand-shale sequence of Miocene-Pliocene age. Since the structure is cut by numerous faults which form permeability barriers, there are many separate reservoirs.

Land facilities . . . Crude from Seria is moved by pipeline to Shell's refinery at Lutong, in Sarawak, the only refinery in British Borneo. The plant has been rebuilt and enlarged since its destruction during the war, and it now has a capacity of 47,300 bbl. per day. Tankers are loaded from sea lines which stretch 3½ miles from shore.

A natural-gasoline plant recently was

BRITISH BORNEO'S only refinery, rebuilt and enlarged since its destruction in World War II, processes crude produced by Shell at its prolific Seria field in Brunei and the older Miri field in Sarawak. The refinery has a capacity of 47,300 bbl. daily.

completed at Seria, and extracted light fractions (about 2,000 to 2,700 bbl. per day) also are being piped to the Lutong refinery.

While increasing its exploration program and production facilities, the company has carried out a big building program to provide accommodations for its expanding staff of local and expatriate employes. More than 1,600 modern concrete houses have been built, and all communities have their own clubs and recreational facilities.

The Brunei Government is using its income from royalties in building up communications, health, and educational facilities and in development of the agricultural industry throughout the protectorate.

Adjoining colonies . . . Brunei lies between the crown colonies of Sarawak and North Borneo, the other two British territories on Borneo. The three states comprise the northern and northwestern part of the island.

North Borneo, the most northerly of the three states, has no oil production as yet. However, Shell Co. of North Borneo has made geological and geophysical surveys of many areas of the state and recently drilled an unsuccessful deep test on the Klias Peninsula.

Another member of the Royal Dutch-Shell Group—Sarawak Oilfields, Ltd.—is active in Sarawak.

The company operates the Miri oil field and the nearby refinery and loading facilities at Lutong. Miri field, which was discovered in 1911 and has produced 73,000,000 bbl. of oil, is now in the stripper stage. Current production is about 1,450 bbl. daily.

MOUNTED RIG services shallow wells in Seria field, which produces both shallow and deep oil from at least 30 zones.

World Output Down

September crude production drops nearly 40,000 bbl.; U. S. down 16,500 bbl., other nations cut 22,700 bbl.

FREE-WORLD production of crude oil continued to show a decline in September, dropping nearly 40,000 bbl. daily below the August total.

September output averaged 12,030,100 bbl. daily. The drop from August's average of 12,059,300 bbl. daily was the fourth successive monthly reduction in free-world crude-oil flow. An upturn is expected to set in later in the year as a result of the usually heavier winter demand.

Of the decline, 22,700 bbl. daily was attributed to lower production in non-Communist countries outside the United States. The remaining 16,500-bbl. daily decrease was in domestic output. The United States production of 6,150,000 bbl. daily in September was more than 400,000 bbl. daily below last January.

During the first three quarters of 1954, free-world production showed a gain of 2.8 per cent. Output during this period was 12,163,000 bbl. daily, compared to 11,836,400 bbl. daily during the corresponding period of 1953.

Much sharper increases in oil consumption outside the United States is reflected in the fact that non-Communist foreign production rose 9.4 per cent, or from 5,301,000 bbl. daily to 5,800,000 daily, in the first three quarters of 1954 over the same period of 1953. Demand in the United States, where crude production still makes up more than half the free-world total, probably will not show a gain of much more than 1 per cent this year.

Middle East . . . The Middle East continues as the actively expanding producing area of the world. During Sep-

CRUDE-OIL PRODUCTION
(Daily average in thousands of barrels)

Country—	Sept. 1954	Aug. 1954	Sept. 1953
W. Hemisphere:			
Argentina	79.0	78.5	78.9
Bolivia	5.0	4.7	1.6
Brazil	3.0	2.6	2.4
Canada	285.0	290.0	274.5
Chile	5.0	4.5	3.8
Colombia	105.2	103.7	108.6
Cuba	0.1	0.1	0.1
Ecuador	8.5	8.6	8.1
Mexico	237.0	235.0	196.7
Peru	47.0	46.4	44.5
Trinidad	65.5	65.4	61.3
Venezuela	1,852.8	1,824.2	1,709.5
Total	2,693.1	2,663.7	2,490.0
W. Europe & Africa:			
Algeria	1.4	1.3	1.5
France	13.0	10.4	7.3
Fr. Morocco	2.5	2.5	2.1
W. Germany	54.2	53.0	45.2
Italy	1.5	1.4	1.8
Netherlands	18.7	18.5	16.7
Egypt	37.3	37.1	45.4
United Kingdom	1.2	1.2	1.1
Total	129.8	125.4	121.1
Middle East:			
Bahrain	30.1	30.3	30.1
Iran	32.0	30.6	25.9
Iraq	644.5	639.9	609.2
Kuwait	931.0	1,011.3	823.5
Neutral Zone	24.0	20.0	
Qatar	97.3	97.1	91.4
Saudi Arabia	941.9	919.1	835.9
Turkey	1.4	1.2	0.4
Total	2,702.2	2,749.5	2,416.4
Other Asia:			
British Borneo	99.0	98.7	101.3
Burma	3.5	3.5	3.4
India	7.0	7.0	6.6
Indonesia	210.0	220.0	196.0
Japan	5.6	5.7	6.1
New Guinea	13.5	12.9	4.8
Pakistan	5.5	5.5	3.3
Total	344.1	353.3	321.5
Total non-Communist foreign	5,869.2	5,891.9	5,349.0
United States	6,150.9	6,167.4	6,557.2
Total	12,020.1	12,059.3	11,906.2
Russia & Eastern Europe:			
Russian zone of Austria	62.0	62.0	65.0
Romania	110.0	110.0	95.0
Russia	1,160.0	1,160.0	1,060.0
Other Communist	36.8	36.8	34.7
Total	1,368.8	1,368.8	1,254.7
World total	13,388.9	13,428.1	13,160.9

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for certain other countries, particularly in Southeast Asia, for which completely current reports are lacking. Iranian production shown is net output, or the gross less recycled material. Other Communist includes China and Yugoslavia as well as the Soviet satellite countries in Europe.

tember, output was off 47,300 bbl. daily, compared to August, but for the first 9 months of 1954 production gained 11.1 per cent from 2,411,500 bbl. daily to 2,679,000 bbl. daily.

Lower production in Kuwait and Saudi Arabia were responsible for the decline in the Middle East in September. In Iraq, September production averaged 644,500 bbl. daily, a new all-time high which was 4,600 bbl. daily above August and 2,700 bbl. daily above the previous record in July.

Most of the increase in Iraq was attributable to Zubair field in the southern part of the country. Zubair averaged 111,300 bbl. daily in September. Kirkuk field produced 496,800 bbl. daily, and Ain Zalah, 24,400 bbl. daily. For the first 9 months of 1954, Iraq production averaged 620,100 bbl. daily, consisting of 489,300 bbl. daily in Kirkuk, 92,500 bbl. daily in Zubair, 26,300 bbl. daily in Ain Zalah, and 12,000 bbl. daily in Khanaqin.

Leading country in the Middle East for the first 9 months was Saudi Arabia which averaged 956,100 bbl. daily. Kuwait, which was high in the Middle East in 1953, produced an average of 923,100 bbl. daily during the first 9 months.

Europe . . . In western Europe, production from Esso Standard's new Parentis field in southwestern France made up approximately half the country's entire crude output in September. Output in West Germany scored another small increase to reach a new record of 54,200 bbl. daily. During the last 5 years, West German crude production has increased more than fourfold.

Ras Matarma field in the Sinai Peninsula area of western Egypt was brought into commercial production in September. The field's output of 1,200 bbl. daily partially offset a further decline in the country's production. Egyptian output began dropping back late last year because of depletion of Asl field which is now down to 6,600 bbl. daily. Ras Matarma has been shut in for the last 5 years because of a legal dispute between the operators, Anglo-Egyptian Oilfields, Ltd., and Socony-Vacuum Oil Co., Inc., and the Egyptian Government. Initial results in producing Ras Matarma were less than had been hoped for.

Western Hemisphere . . . In the Western Hemisphere, Venezuelan crude production showed an increase of 28,600 bbl. daily in September. The crude-oil output of this South American country, which runs heavily to fuel oil, normally turns up after the summer months. For the first 9 months, Venezuelan production averaged 1,858,900 bbl. daily against 1,731,600 bbl. daily in the same period of 1953, a gain of 127,300 bbl. daily.

Chilean production is expected to show some further gains since the country's first refinery, the new modern plant at Concon, near Valparaiso, went on stream the latter part of September. Brazilian crude production was up to 3,000 bbl. daily in September. This crude is used to charge the newly expanded Petrobras refinery at Mataripe in Bahia.

TREND OVER THE LAST YEAR
(Thousands of barrels daily)

	Western Hemisphere less U. S.	Middle East	Total non-Communist foreign
1953—			
October	2,519.5	2,528.1	5,511.5
November	2,651.9	2,341.7	5,461.6
December	2,711.9	2,540.2	5,714.1
1954—			
January	2,682.8	2,491.2	5,636.4
February	2,703.7	2,550.6	5,695.3
March	2,642.9	2,767.6	5,872.7
April	2,565.1	2,642.0	5,653.1
May	2,639.3	2,766.0	5,863.8
June	2,648.5	2,685.0	5,805.5
July	2,667.0	2,758.7	5,890.9
August	2,663.7	2,749.5	5,891.9
September	2,693.1	2,702.2	5,869.2

Hawaiian Refinery Planned

The first major oil refinery in the Hawaiian Islands will be constructed in the near future by Standard Oil Co. of California, R. G. Follis, chairman of the board, announced last week.

The refinery, costing an estimated $25,000,000 to $30,000,000, will have a daily crude capacity of 20,000 to 30,000 bbl. It will be erected in the Honolulu area. When completed, it is expected to be capable of supplying most of the oil products consumed in the islands.

The only refinery now operating in Hawaii is a small plant owned by Pacifc Refiners, Ltd. It processes heavy crude mixed with butane.

Cuban Deal Closed

Trans-Cuba acquires half interest in Trust acreage

TRANS-CUBA OIL CO., backed by a group of Cubans, has obtained an undivided 50 per cent working interest in Cuban-Venezuelan Oil Voting Trust's acreage in Cuba. In return, Trans-Cuba agreed to spend $3,000,000 on exploration and drilling.

C.V.O.T. controls 14,875,000 acres held under concession by 24 companies which it manages. Its chairman is Warren W. Smith. Cubans who organized Trans-Cuba and raised the $3,000,000 for the deal include Viriato Gutierrez, Jose M. Bosch, Jose Ignacio de la Camara, and Alejandro Suero.

Henry E. Linam, an independent oil operator of Shreveport, La., and former president (1932-1943) of Standard Oil Co. of Venezuela, has been engaged to organize and manage operations for Trans-Cuba.

Current activity . . . Drilling already has started on the first Trans-Cuba well. The location is near the port of Jucaro, 3 miles north of the town itself and west of the Jucaro-Ciego de Avila railroad. It is on the southernmost land point of the central sedimentary basin in which the Echeverria discovery was made last May. Jones Brothers Drilling Co., Shreveport, which has a contract for the operations, moved a Brewster rig in for the test.

Cuban American Oil Co., headed by Tevis Morrow, Los Angeles, in combination with the Grady Vaughn-H. W. Klein interests of Dallas, holds 750,000 acres and an option on another 750,000 acres in Cuba under an agreement with Trans-Cuba Oil and C.V.O.T. *(The Oil and Gas Journal, October 11, page 120).*

Burma Recovering

Plans to rebuild refinery near Rangoon are disclosed

THE long-depressed Burmese oil industry is taking another step toward recovering some of its prewar importance.

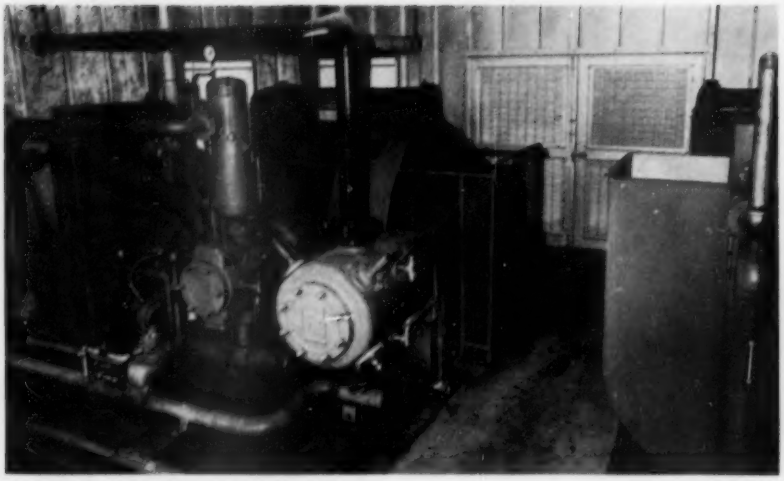
An announcement from Rangoon last week said Burma Oil Co. (1954), Ltd., had decided to rebuild the Syriam refinery. This plant is situated near Rangoon. Before the war it refined much of the crude produced by the then-thriving Burmese oil industry.

The rebuilding job will be carried out by the reorganized company which was formed earlier this year when the Burmese Government bought a third interest in the British-owned Burma Oil Co.

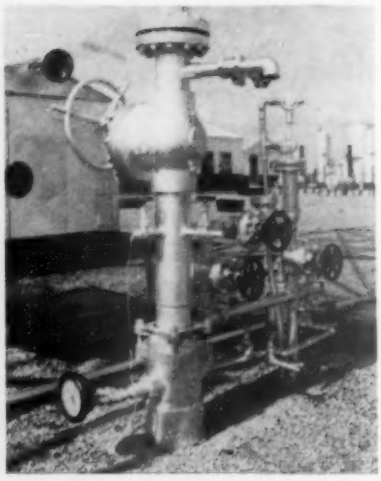
In 1939, B.O.C.'s Syriam refinery had a capacity of 20,000 bbl. daily with 3,000 bbl. daily in Dubbs thermal cracking. It was connected with the main producing fields up the Irrawaddy River by a 327-mile pipeline. All these facilities were destroyed by the British when they retreated from Burma in 1942.

Although Burma hopes eventually to regain some of its export oil trade, the immediate goal is to provide for internal consumption.

Last January, the Burma company placed new facilities in operation to give the small refinery at Chauk, in the field area, a capacity of about 3,000 bbl. daily. This expanded plant, together with the new facilities to be built at Syriam, will meet domestic requirements for all major petroleum products.



1. Air is compressed here . . .



2. Injected into this well . . .

In Situ Combustion Field-Tested Again

A year ago, The Oil and Gas Journal carried the first paper on the work of Magnolia Petroleum Co. in the in situ combustion process of oil recovery. Since that time, a second series of tests has been under way in the same field of Jefferson County, Oklahoma. The principal objective of this second field test is to establish a relationship between field observations and computations. Eventually, as the results of this work become available and correlations are developed, a realistic economic appraisal of the process should be possible. Also, significant refinements in the process in regard to techniques of operation should be evident.

by R. L. Koch, J. F. Gleason, Jr., and W. G. Boston

THE in situ method for the recovery of crude oil from underground formations is based upon the generation of thermal energy by burning a small portion of the reservoir's oil while still in place. The first field test utilized a three-well, inline pattern.[1] In the current and more extensive field test of the method in that same location in Jefferson County, Oklahoma, a five-spot well pattern is utilized.

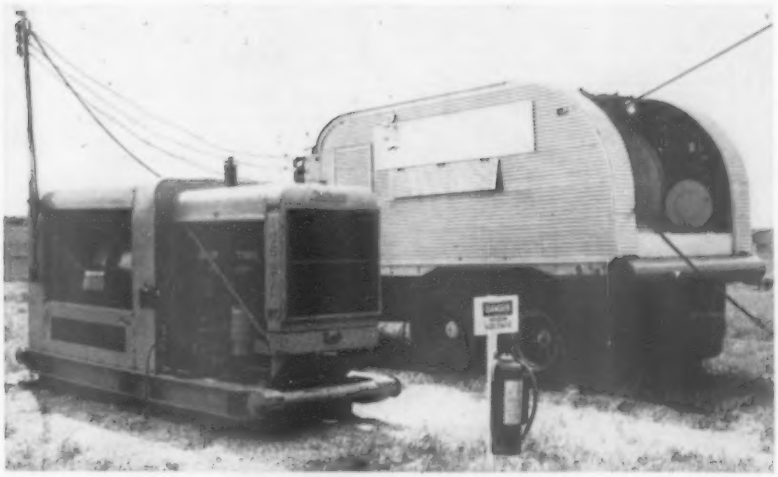
A high-temperature burning region is to be formed near a centrally located injection well by ignition of the crude oil contained on the sand. Upon supplying an oxygen-bearing gas (in this case, air), combustion occurs and a burning front travels from the central injection well toward four equidistant production wells, forming the five-spot pattern. Crude oil and water are swept ahead of the front as a result of the combined effect of the heat generated by combustion and the flow of combustion gases.

Authors are with Magnolia Petroleum Co., Dallas. Paper presented at Petroleum-Mechanical Conference of A.S.M.E., Los Angeles.

The test and the installation are designed to produce information of an engineering nature on volumetric sweep efficiency, the amount of air required to support combustion, and air supply requirements as related to the rate of advance of the burning front. Information on all of these factors is needed for an economic evaluation of the application of in situ combustion to oil sands. In view of the nature of the test, the facilities were designed to give adequate flexibility of operation and precise control of process variables, with special measures being taken to procure data on underground combustion phenomena and the resulting oil recovery. Since this installation is designed primarily for experimental purposes, it should not necessarily be used as a basis for the design of commercial-type facilities.

The installation is above a small sand lens lying at a depth of 180 to 195 ft. and covering an area of 30 acres. In the portion of the lens being used for these tests, the sand has a thickness of 15 to 20 ft. A plat of the 10-acre test site (NE NE SE 21-T3s-R5w) showing the location of the five-spot well pattern and the surface installation is presented in Fig. 7.

The first field test conducted in this lens demonstrated that oil sand could be ignited and that a burning front could be moved through the sand and additional oil produced thereby despite the exceptionally high viscosity of the oil (about 7,300 cp. at reservoir conditions). Furthermore, the results obtained aided in the design of this second and more comprehensive test. In the subject test, the distance between the centrally located injection well and the four production wells defining the inveerted five-spot well array is 40 ft. In addition, there are four pairs of observation wells strategically located between the injection well and the pro-



3. Is ignited by current generated here . . .

4. Production comes from these four wells . . .

duction wells for the purpose of observing the advance of the burning front.

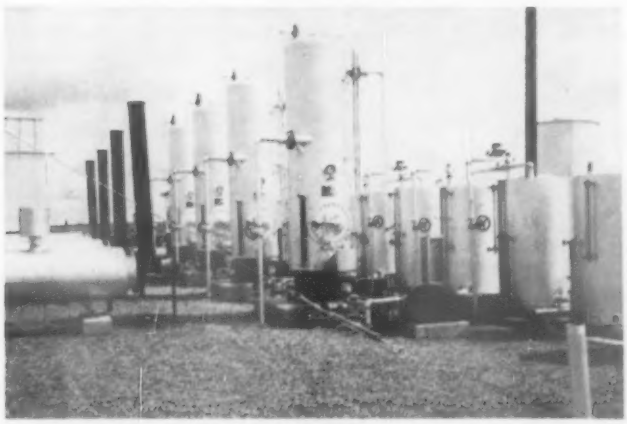
Fig. 8 shows the relationship of the four main components comprising the installation: (1) an air-injection system; (2) an ignition system; (3) an observation system; and (4) the liquid and gas-recovery system.

A photograph of the entire installation is shown in Fig. 4. The injection well is located directly under the derrick and the four production wells are at the bases of the masts. The armored power cable going to the igniter is in the foreground, the operations building is in the background, and the fluids-gathering system together with the oil storage tanks are at the right.

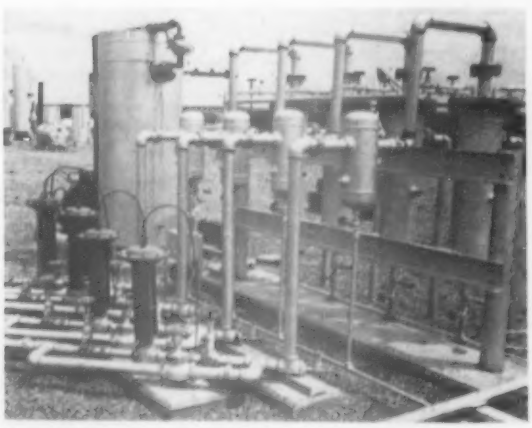
Well Completion

Fig. 9 shows the four types of test wells. Surface pipe, either 7 or 9⅝-in. was cemented at least 25 ft. above the oil sand to prevent exposure of the cement to the high temperature created by underground combustion. The hole was continued to within about 3 ft. of the top of the sand, and the mud system then removed. For the remainder of the drilling and/or coring, air was used as the drilling fluid so as to prevent contamination or plastering of the oil sand with drilling mud. Directional surveys and electrical logs were run on each well; for electrical logging, the hole was allowed to fill with formation water.

In the injection well, a 6⅝-in. liner having ¼-in. by 3-in. slots was placed opposite the sand section, suspended at the surface from the 9⅝-in. casing, and held off bottom to allow for expansion upon heating of the well up to 1,200° F. during the ignition period. To provide for the removal of liquids, the well is equipped with a string of ¾-in. line pipe extending below the sand section.



5. Is run into these separators . . .



6. And gas is recovered here

In the temperature-observation wells, 12 thermocouples, spaced at 2-ft. intervals, are placed along the sand section to furnish information for constructing temperature profiles of the front as it moves through the formation. After the thermocouples were inserted, these wells were backfilled with sand to insure intimate contact between the temperature-sensing elements and the oil sand. The main purpose of the other observation well is to secure bottom-hole pressure-temperature data and liquid and gas samples. The two wells comprising each pair of observation wells are spaced 4 ft. apart.

In both the production and observation wells, wire-wrapped screen pipe is used for liners. The liners in the production wells are wrapped with galvanized wire, whereas the ones in the observation wells are wrapped with stainless-steel wire so as to withstand the high temperatures generated by combustion. The production wells also are equipped with thermocouples to detect approach of the burning front.

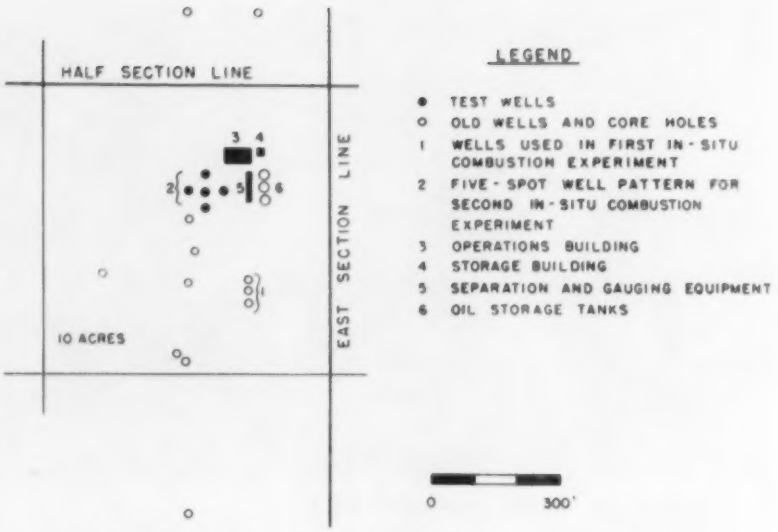


Fig. 7—Plat of 10-acre test site for Magnolia's in situ combustion experiments.

Ignition System

A specially designed electric heater is used to ignite the oil sand. This igniter comprises six 9-kw. heaters encased in a 40-ft. length of 4½-in. stainless-steel pipe. The igniter is run into the injection well on ⅞-in. armored cable and positioned opposite the sand face. The cable contains three No. 7 gage copper power leads and three No. 14 gage leads to two temperature-sensing elements. The two temperature-sensing elements, a chromel-alumel thermocouple, and a thermistor are located in the igniter and are connected to temperature-measuring instruments housed in the control truck. A lubricator and shutoff valve are installed on the injection well so that the igniter may be removed after combustion is established but while the well is still under pressure.

A 75-kva., 3-phase, 220/400-volt generator provides electrical power for the igniter. A photograph of the generator and control truck is shown in Fig. 3. The output voltage from the generator can be increased to 535 volts by control of the field excitation on the generator. A further increase to 800 volts is obtained through 1:1.5 dry-type transformers. The temperature of the igniter can be controlled over a range of 250° to 1,400° F. by adjusting line voltage.

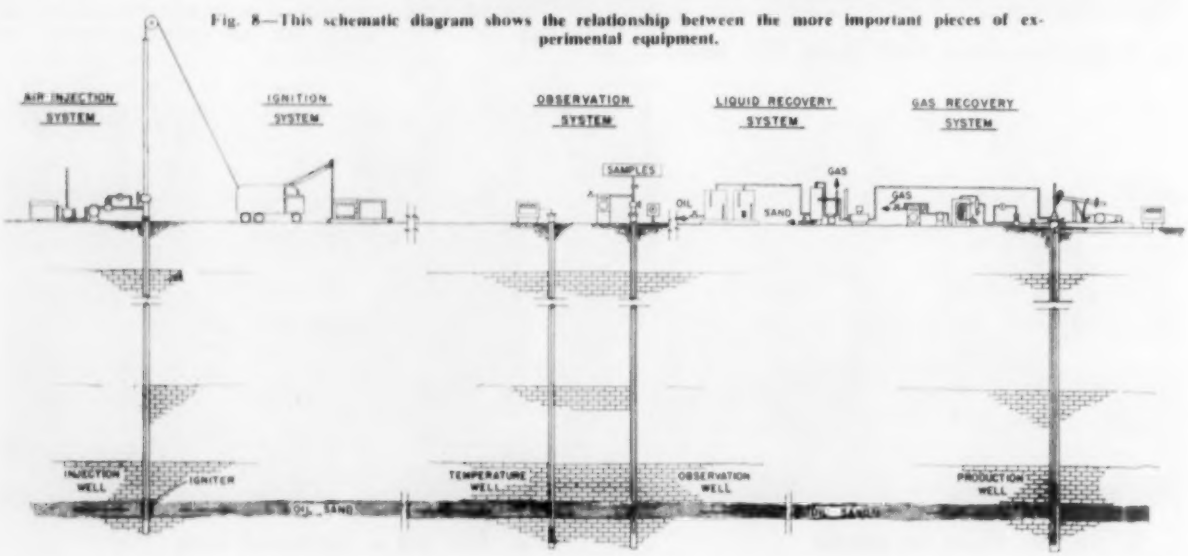
A 5-ton control truck houses a 24-in.-diameter by 5-ft.-wide winch for the cable and also an engine with a multiple-speed transmission for driving the winch. In addition, this truck contains the weight and depth-indicator instruments, a multipoint temperature recorder, the two transformers, an adjustable voltage regulator, and the electrical power-measuring instruments which include three voltmeters, three ammeters, and one watt-hour meter.

Since the ignition system can be broken down into its individual elements, the entire assembly is portable and can be moved to different locations.

Air-Injection System

Air for supporting combustion is supplied by two, two-stage packaged compressors. A photograph of one of the units is shown in Fig. 1. Each machine has a 64-b.hp. compressor driven by a 130-b.hp. gas-gasoline engine. The machines have a combined maximum capacity of 630,000 standard cubic feet per day of air at discharge pressures up to 200 psig. They are connected in

Fig. 8—This schematic diagram shows the relationship between the more important pieces of experimental equipment.



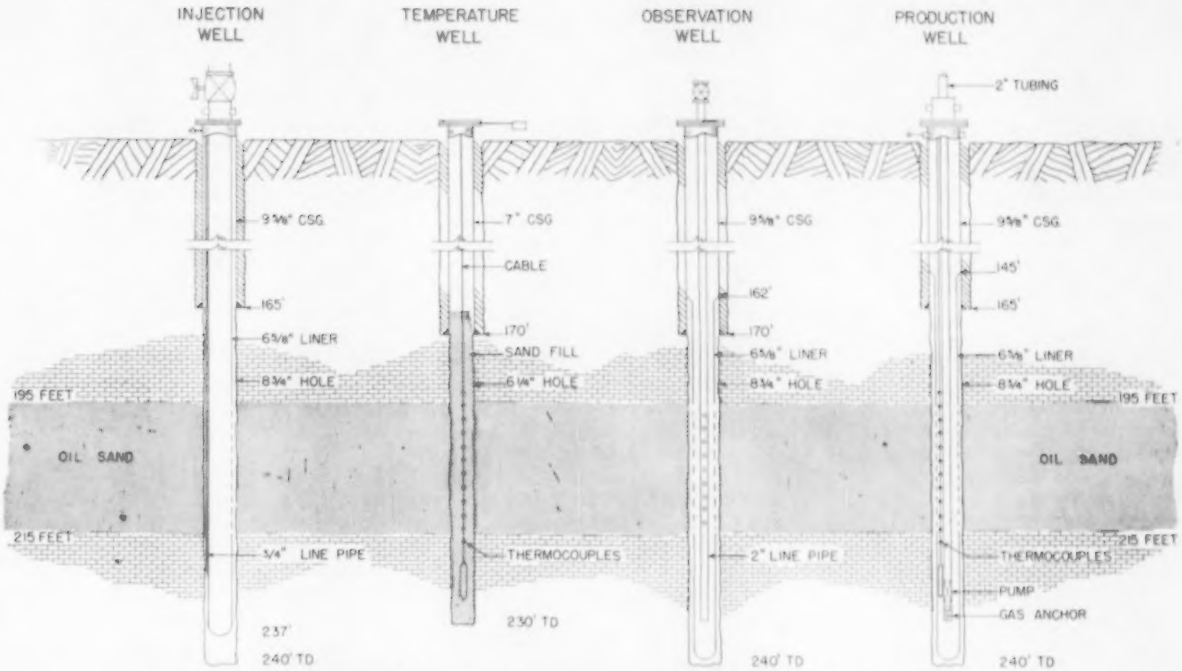


Fig. 9—The test wells are of these four types and with these varieties of completions.

parallel and can be operated individually or simultaneously. The machines are automatic in operation; they are equipped with speed controls and free-air unloaders actuated by the discharge pressure.

A pressure regulator and a flow recorder-controller are installed in the air-injection line. The pressure regulator may be used alone, but when the flow controller is in operation, the pressure regulator is set to maintain 150 psig. upstream of the flow controller. The value of 150 psig. is estimated to be the safe maximum pressure to apply to the subsurface formations involved in this test.

The injected air is metered by a positive-displacement meter and an orifice-type meter, the former being connected in parallel to a spare. The orifice meter, utilizing a ring balance, has an adjustable differential range. It is equipped with temperature and pressure compensators, and can meter in a range from 200 to 100,000 standard cubic feet per hour with the size of meter runs installed. From the 2-in. meter runs, the air flows to the injection well head shown in Fig. 2. The air line is the 2-in. vertical pipe coming up from the ground just to the right of the well.

Fluids-Recovery System

Individual fluids-recovery and metering systems are installed on each of the four production wells to permit close observation of the performance of the wells and adequate control of the process. The location and arrangement of these facilities are shown in Fig. 5. To the left are the four horizontal heaters, in the center are the gas-oil separators, and to the right are shown the twin gaging tanks. To allow for flexibility in the operation, the flow of fluids can be directed through or around the heaters and separators before going to the gaging tanks.

Two-inch conventional plunger-type pumps are used to lift the oil and water in the production wells. The pumping units are equipped with electric motors and variable-speed drives, operable from 10 to 40 s.p.m. This flexibility was deemed necessary because of the increased liquid production rates anticipated.

To separate produced oil, water, and some sand, the total liquid stream from each of the production wells is heated separately by gas-fired indirect heaters. The produced liquids, flowing through the tube side with water on the shell side, are heated to 180° F. After heating, the liquids flow to a separator from whence gas is metered and analyzed; the information obtained is later incorporated into the combustion

Fig. 10—Floor plan of operations building showing locations of test equipment and instrument panel boards.

calculations. The vertical gas-oil separators, 30 in. diameter by 10 ft. length and equipped with automatic float-operated dump valves, are installed in the line immediately following the heaters. In addition to separating the gases from the liquids, these separators also serve as settling tanks; accumulated sand is removed from the bottom. The separation of the solid materials at this point prevents clogging of lines, liquid meters, and gaging tanks beyond the separators.

Out of the separators . . . During the operation, pressures maintained on the separators are at times insufficient to force liquids through the meters and into the gaging tanks, therefore, screw-type transfer pumps are used for this purpose. One of these pumps, located just to the right of the first separator is shown in Fig. 5. Before entering the gaging tanks, the combined volume of the oil and water is metered by disk-type meters.

Since the dependability of a number of the correlations to be derived from the results of the experiment is contingent upon the accuracy of gaging, two methods are employed for metering oil and water production. Two 250-gal. gaging tanks are connected in parallel. These tanks are used for separating the produced oil and water. When one tank is full, the contents are allowed to stand undisturbed until separation of the oil and water is complete. The amounts of oil and water can then be gaged. In the second method, water is drained from the bottom of the tank and metered by a disk-type meter. By subtracting this meter reading from the reading on the meter in the line ahead of the gaging tanks, the oil-volume reading is obtained for checking against the tank gagings.

The oil is pumped from the gaging tanks to three 65-bbl. storage tanks where the produced oil from the four wells is composited. The water, as well as the sand from the separators, is drained to a slush pit and discarded.

The oil lines are steam-traced and insulated from the production-well heads to the storage tanks, and the gaging and storage tanks are heated with steam fingers. This was done so that the heavy, viscous crude oil could be handled more easily during winter months.

Produced gases . . . In controlling the process, one rather important objective is to maintain the location of the burning front in the oil sand reasonably symmetrical throughout each of the four quadrants of the well pattern. Since this control depends upon accurate measurements of the individual gas-production rates and analyses of each of the produced gas streams along with a knowledge of the combustion characteristics of the material being burned, the produced gas streams from the four wells are metered and analyzed separately. The produced gas from the casing passes through the shell side of a shell-and-tube-heat exchanger. A photograph of these exchangers and the refrigeration unit is shown in Fig. 6. Cold water supplied from a refrigeration unit is circulated through the coils.

The refrigeration system is designed to cool the produced gases to as low as 20° F. at gas production rates as high as 300,000 standard cubic feet per day. These heat exchangers have a two-fold purpose. First, high-boiling constituents are condensed and collected in the exchanger and in a mist extractor just beyond the exchanger. This trapped liquid provides a sample for determining the amount of light hydrocarbons resulting from the process; also, the amount of condensate obtained enters into materials balance calculations. Secondly, the exchanger helps to remove moisture from the gas and thus prevents accumulation of condensate in the gas-metering and analysis equipment.

The volume of air flowing to each production well underground, and consequently the rate of movement of the burning front, can be affected by regulating the back pressure on the production well while holding the injection-well pressure constant. This is the method used in maintaining burning-front locations reasonably symmetrical in each of the four quadrants. A pressure recorder-controller is connected to control valves in the gas-discharge line from the casing of each well; these control valves are shown in Fig. 6.

Two positive-displacement gas meters of different capacities are connected in parallel to meter the produced gas from each production well. The meters were selected so that the ranges of best accuracy of the two meters in each system overlap. The smaller meter registers the volume of gas at flowing conditions; the large meter is equipped with a base volume index and integrates the flow rate and registers the cumulative gas flow expressed at standard temperature and pressure.

Between the mist extractor and the back-pressure control valve there is a gas-sampling point. A line from this point carries a stream of the combustion gas to a sampling manifold where it is diverted to the different pieces of analytical equipment.

Following the test . . . The rate of development of effective permeability to air in the sand body prior to actual combustion is an important feature of this test. During the combustion phase of the experiment, information about ignition, combustion, air requirements, heat-transfer rates, and oil and water production are of paramount interest. Data on the rate of burning-front advance, effective air permeability downstream of the burning front, and efficiency of combustion, that is, the percentage oxygen utilization, as obtained from the observation wells, will be of great value in attempting to translate the basic information derived from this test to fields having different well geometries and reservoir conditions.

To follow the course of the test, and to compare at frequent intervals the field results with laboratory-test results, a potentiometric model study is to be run simultaneously with the field experiment. Although this comparison will give an estimate of the areal burnout efficiency resulting from combustion, core holes will nevertheless be drilled to obtain positive evidence of the volume of sand burned and the volume of sand having significant oil depletion.

Reference

1. C. S. Kuhn and R. L. Koch, "In Situ Combustion—Newest Method of Increasing Oil Recovery," The Oil and Gas Journal, August 10, 1953, p. 92.

BOOKS

THE DEPLETION ALLOWANCE AS APPLIED TO OIL AND GAS INCOME FOR TAX PURPOSES. By Frank W. Levett. Published by the author, 1801 University Boulevard, Abilene, Tex. 57 pp., $5.

How does the depletion allowance affect the tax rate on oil and gas production income? Who can and cannot claim the allowance? And how have the courts ruled on taxation questions in this regard?

This text was designed to answer these and other complex questions simply and briefly. It does just that. Its 57 pages contain a highly concentrated presentation of the depletion allowance and tax laws affecting it, along with numerous abstracts of court rulings on questions at issue. In short, it should be a welcome addition to the reference shelves of anyone wanting a working understanding of the subject without having to work too hard to get it.

LOUISIANA GULF COAST WILDCAT MAP. Published by Austin Oil & Gas Publishing Co., Box 5146, Austin. $8 per month.

A new monthly series of wildcat maps covering the Gulf Coast of Louisiana, published in two parts: one includes the east half, and the other the west half. Each map is 35 by 45 in. and is drawn on the scale of 1 in. to 20,000 ft. Base maps constructed from Louisiana governmental sources are much more detailed than previous publications of this nature; ranges, townships, sections, highways, oil and gas fields, and major structural features are shown in black while current drilling wells and recent discoveries are overprinted in red. Land men, geologists, and engineers should find these maps extremely useful in following oil and gas developments, and to executives they should prove a real asset as a quick check on area activities. The drafting is unusually detailed and is well done. Water and land areas are clearly shown by proper symbols as well as the many marsh areas.

MOBILE EQUIPMENT can be used in mountainous country such as this near Pagosa Springs, Colo., although at times it is necessary to use "cats" to get to the location.

Rigs on wheels . . . Here's why they

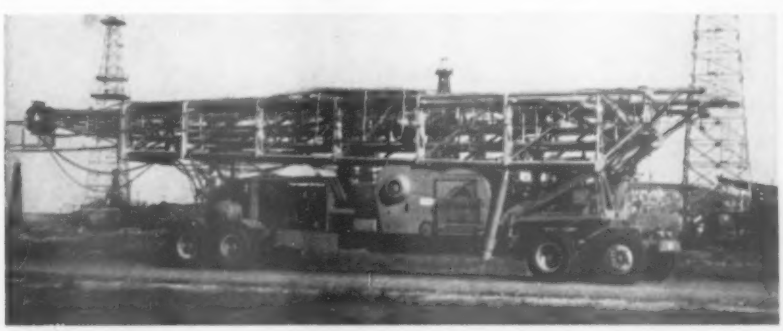
Drill More Wells—Faster, Cheaper

by Norman S. Morrisey
Production Development Editor

TO reduce drilling costs and to meet competition, the drilling industry is turning to trailer-mounted or self-propelled drilling rigs wherever possible.

Time spent in rigging up and tearing down consumes valuable hours or even days. Substantial savings can be effected with the use of mobile rigs, particularly in shallow producing areas. In these areas moves may represent 10 per cent or more of the total time necessary for drilling a well including rigging up and tearing down. The time required to drill a well is about the same, using either mobile or conventional skid-mounted rigs. Many contractors consider that the hours or days saved in moving gives them a decided edge on their competitors.

Well completions in 1954 are about 10 per cent above the 1953 figure. Most of this increase is in shallow fields where production occurs at 5,000 ft. or less. It is in these areas that mobile or trailer-mounted rigs shine. Although maximum drilling depths for this equipment normally are 5,000 to 7,000 ft. with 4½-in. drill pipe, optimum drilling ranges are between 3,000 and 5,000 ft.



SELF-PROPELLED RIGS are one answer to reducing moving costs in shallow areas. The engine over the rear wheels provides power for draw works and has a power takeoff to propel the vehicle over the road.

Results reported have been highly favorable. On one wildcat drilling program, the contractor estimates a savings of approximately 3 days per well plus a substantial reduction in trucking expenses. On this particular program in the Williston basin, the contractor is engaged in drilling a series of 2,800-ft. wildcats that require about 5 days to drill and complete. Well locations are about 10 miles apart. The contractor estimates that he can tear down, move, and rig up in 12-14 hours. This means an average of about 5½ days per well instead of 8½ using conventional drilling equipment. A 10-well program under favorable conditions would require 55 days as opposed to 85 days.

From a contractor's point of view, it means he can drill 15 wells in the time normally required to drill 10. He

would drill 43,500 ft. of hole in the same time required to drill 28,000 ft. of hole, using his old equipment. At an estimated $3 per foot, this would be an increase in gross revenue of $46,500 in less than 3 months' time.

The above example had favorable conditions where terrain and weather are no problem, and moving requires considerable time in proportion to the number of drilling days per well.

Empire Drilling Co., of Albuquerque, is operating a trailer-mounted rig capable of going to 4,000 ft. with 4½-in. drill pipe. The rig cost $130,000 including the trailer mount, or about $7,500 more than a conventional substructure. This company is operating in rugged terrain where lack of bridges and poor roads make moving a problem whether mobile equipment is used or not. This company figures a savings of about $200 per well on a 12-well field development program under adverse moving conditions. It will take about 40 moves to pay for the added cost of the trailer, but the payout on this piece of equipment is less than a year. Empire considers that the trailer rig would save the firm considerably more than $200 per move if road conditions were more favorable.

The cost of moving and rigging up a trailer-mounted drilling unit has been recorded as low as $68, and averages between $200 and $400. On a comparable skid-mounted unit, and under similar conditions, the moving costs would run from $1,200 to $1,700 and sometimes higher. Another very important point is that the number of trucks or semitrailers required to move the complete rig is sizably reduced in the case of the mobile equipment.

Equipment design . . . Manufacturers are faced with a serious problem in designing mobile equipment because of weight and dimension limitations imposed by various state-highway departments. Unfortunately, these laws are not uniform, and what is a legal load in one state is illegal in another (Tables 1 and 2). In addition, the wording of the laws makes them ambiguous. An illegal load is defined, but more often than not it is difficult to determine what is a legal load.

The equipment, however, is designed to comply with state laws, although in some states special permits are required to move the rigs on highways.

Several companies that manufacture service units put out a dual-purpose service unit and mobile drilling rig. These units are extremely versatile, particularly those that are self-propelled.

Limitations of trailer rigs . . . What are the limitations of these trailer-mounted drilling and servicing units? To start with, many mobile rigs fully equipped with traveling block, drilling line, sand line, etc.—weigh in excess of 100,000 lb. To arrive at the gross vehicle weight, the weight of the truck tractor must be added to the weight of the trailer which may bring the gross vehicle weight up to 125,000 lb.

In the State of Texas, 58,420 lb. is the maximum legal load. Therefore, for any load in excess of 58,420 lb., a permit must be obtained. However, such permits expressly forbid any movement of the vehicle on week ends or holidays. In this manner, a drilling rig may be tied up for 2 days, representing a direct loss to the operator. Most comparable skid-mounted rigs fall in the overweight class and are also permit loads. Thus, the weight and size of the load are not a problem that applies only to mobile rigs.

In Oklahoma, there is the added disadvantage that if a load is separable an overweight permit may not be granted. The operator can remove the derrick, blocks, drilling line, and sand line, however, to obtain a legal package.

Colorado, on the contrary, has enacted special laws applicable to oilfield equipment, that minimize restrictions on the cost and legality of highway moves.

In the main, however, highway restrictions are getting tighter all the time. The pressure is on overweight vehicles, and this pressure will increase through the years. Therefore, the manufacturer must strive to achieve legal weights, even though it is not possible to attain legal physical dimensions.

In the larger sizes of trailer-mounted drilling rigs, a step has been made in this direction by placing the mast on a second trailer, thus splitting the original load into two legal trailer packages.

MOBILE EQUIPMENT has already proved its worth in all types of climates, ranging from springtime in the Rockies to winter in Michigan

In the lighter servicing units, a partial solution lies in the newer self-propelled units which automatically reduce some 10,000 lb. of the gross vehicle weight by eliminating the requirement for the truck tractor.

Further progress can be made by the use of lighter metals, as far as the economics of the situation will allow.

Where can mobile rigs operate? . . . Probably the best answer to that is "any place where conditions are favorable." Although these mobile units are primarily designed for drilling wells in the 3,000-5,000-ft. class, manufacturers put out several models capable of going below 10,000 ft., using small-diameter drill pipe.

Manufacturers' claims are supported by actual experience in many areas where mobile drilling equipment has already proved its worth. The following list, although not complete, gives a cross-section of the oil fields where mobile equipment is in use:

Canada, Williston basin, Denver-Julesburg basin, San Juan basin, Texas-Oklahoma panhandles, South Texas, Gulf Coast, East Texas, West Texas, Louisiana, California, and of course several countries where load limits are no problems.

In regard to foreign operations, it is interesting to note that one major oil company has established the policy of not buying any skid-mounted equipment in these capacities that can be truck or trailer mounted.

Gulf Coast . . . One manufacturer has made a careful study of conditions along the Gulf Coast where moving conditions are not difficult. The company makes several self-propelled drilling rigs capable of drilling wells from the grass roots to 10,000 ft. In field-development work, they estimate that a contractor can save approximately $450 per move, using a mobile rig rather than a con-

TABLE 1—SUMMARY OF SIZE RESTRICTIONS IMPOSED BY OIL-PRODUCING STATES ON TRUCKS AND TRAILERS*

	Width (ft.)	Height (ft.)	Length: Single unit (ft.)	Length: Tractor-semitrailer (ft.)	Length: All combinations (ft.)	Minimum tandem axle spacing (in.)
California	12	13½	35		60	(†)
Colorado	12	12½	35	60	60	40
Illinois	12	13½	42	45	45	40
Kansas	12	12½	35	50	50	40
Louisiana	12	12½	35	50	60	40
Michigan	12	12½	35	50	50	42
Nebraska	12	12½	35	50	50	(†)
New Mexico	12	12½	40	65	65	40
North Dakota	12	12½	35	47¼	47¼	40
Oklahoma	12	13½	35	50	50	40
Texas	12	13½	35	45	45	40
Wyoming	12	13	40	60	60	40

*This table is a summary only. Detailed restrictions should be obtained from state highway departments. †Not specified.

TABLE 2—SUMMARY OF WEIGHT RESTRICTIONS IMPOSED BY OIL-PRODUCING STATES ON TRUCKS AND TRAILERS*

	Single axle weight (lb.)	Tandem axle weight (lb.)	Wheel weight (lb.)	Max. gross weight permitted—single or combination of units (lb.)	Tires: Wt. per in. width (lb.)	Tires: Measured	Trailer restrictions
California	18,000		9,500	76,800	Solids-600; Pneumatic, not specified.	Channel-base width.	Not specified.
Colorado	High-press. tires, 16,000; low-press. tires, 18,000.		One-half axle weight.	W = 800 (L + 40), where W = gross weight in lb.; L = length between centers of first and last axles.	Steel tired vehicle-500.	Cross-sectional width of tire.	Three trailer units permitted.
Illinois	18,000		Not specified.	72,000	800	Not specified.	A truck tractor semitrailer may draw one trailer.
Kansas	High-press. tires, 16,000; low-press. tires, 18,000.		One-half axle weight.	63,890	Not specified.	Not specified.	One trailer or one semitrailer.
Louisiana	18,000	32,000		64,000			Max. gross weight on a trailer is 36,000 lb.
Michigan	18,000	18,000		Subject to axle weight restrictions.	700		One semitrailer may draw one trailer.
Nebraska	18,000		One-half axle weight.	64,650	No restrictions.	Not specified.	One trailer or one semitrailer.
New Mexico	Pneu. 18,000; solid, 16,000.		One-half axle weight.	76,800	600	Pneu. manufacturers' rating. Solid-flange of rim.	One trailer or one semitrailer.
North Dakota	18,000 (max.).		One-half axle weight.	W = 750 (L + 40), where W = gross weight in lb. and L is distance in ft. between center of first and last axles.	Solids-440; pneu.-550.	Solids-rim width; pneu.-manufacturers' tire width.	One trailer or one semitrailer.
Oklahoma	High-press. tires, 16,000; low-press. tires.		See tires.	60,000	High-press. tires-600; low-press tires-650.	At surface concentrated on highway.	One trailer or one semitrailer.
Texas	18,000.	36,000, truck or tractor.	9,000	58,420	650	Highway surface.	One trailer or one semitrailer.
Wyoming	Pneu. 18,000; solid, 16,000.		Pneu. 9,000; solid, 8,000.	73,950	Not specified.	Not specified.	One trailer or one semitrailer.

*This table is a summary only. Detailed restrictions should be obtained from state highway departments.

ventional jackknife. The moving costs are considerably greater on a 130-150-mile move with a net savings of $1,300 per move. Of course, $1,300 represents an extreme case, but on a 10-well strat-hole program with wells 10-20 miles apart the savings per well would be close to $800.

Hugoton embayment . . . Results in this part of the country with mobile drilling equipment are highly satisfactory because ideal conditions that favor the use of mobile rigs normally exist. The terrain is relatively level; the annual rainfall is very low; and the pay zones are found between 2,500 and 5,000 ft. under much of this vast area.

Service Drilling Co. has moved its trailer-mounted rig 5 miles, rigged up and set surface pipe—all within a period of 12 hours. Its experience with this equipment has been eminently successful. It attributes part of its success in bidding for new contracts and for speed in moving to the use of steel mud pits.

Canada . . . At the mention of Canadian drilling, the listener unconsciously thinks of either the reef fields like Leduc or the foothills fields like Turner Valley and Pincher Creek. Actually these trends represent only a small portion of Canada's drilling today. Shallow production is found over a wide area in all of the oil-producing provinces with the reservoirs at 2,000-5,000 ft.

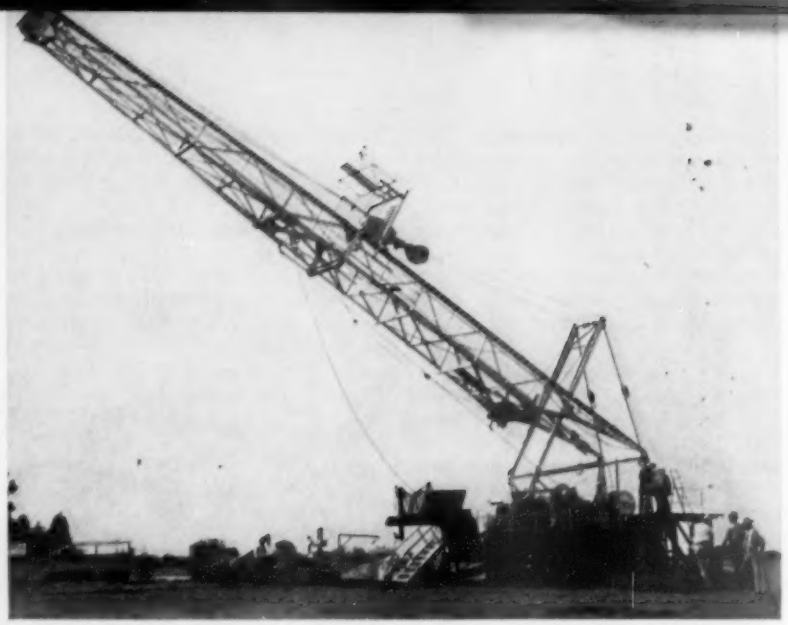
Commonwealth Drilling Co.'s experience in the Virden-Roselea field illustrates how trailer-mounted equipment operates in Canada. Production is from the Mississippian limestone at 2,200-3,400 ft.

Drilling and completion time on these wells averages about 1 week, using three to five rock bits per well. Rigging-up and tearing-down time including actual moving takes about 2 days or 177 man-hours per move. Commonwealth estimates a savings of 50 man-hours and two truck loads per move compared with conventional masts, or a savings of $350 per move.

This particular trailer-mounted rig cost $9,000 more than a conventional mast, but the added cost will probably be paid out in about 6 months.

Objections to trailer rigs . . . No drilling rig is the solution to every problem confronting the contractor, nor is one type of equipment the final answer. Trailer rigs, primarily, are designed to operate in shallow areas where terrain, weather, and roads are favorable.

Many contractors do not like to use equipment that is limited to certain areas of the country. They argue that they are operating anywhere in the United States and cannot afford to use this type of equipment. They contend that in many areas their conventional equipment can be moved as rapidly as the trailer type.



ON LOCATION the contractor can rig up in 2 to 3 hours. Here the mast is being raised during rigging-up operations.

In the Denver-Julesburg basin, one contractor can tear down and move in less than 12 hours, using a conventional rig. He feels that the added expense of the trailer rig is not justified as he has such a short moving period.

The problem of moving rigs over muddy fields is another problem. Under such conditions, the trailer mount is not an asset, according to some contractors. Experience has shown, however, that trailer equipment can be moved over extremely muddy ground.

Factors affecting drilling trends . . . During the past 15-20 years, contractors have been demanding larger rigs to handle oil-company requirements. Shallow production, although not ignored, was of secondary importance. Now, however, deep drilling is out of reach of the majority of small operators. Wildcats aimed at developing pay zones at 10,000 to 14,000 ft. are expensive, probably costing from $150,000 on up. Few companies except the majors can afford this type of exploratory-drilling program.

Fracturing is a factor that is making shallow sands economic. Many sands were passed up during the early development work because of the poor shows that were considered noncommercial. Now, however, the oil companies are going back into these areas and completing wells in these shallow sands.

The importance of seismic work in the exploration program is another major factor that has shifted the emphasis from deep to shallow drilling and from money spent on seismic exploration to money spent on strat drilling.

For the past 30 years, exploration men have allowed seismic results to dominate their thinking. "Where's the shot picture?" or "Where's the seismic hickey?" has been the standard question asked before a wildcat location was spotted. Even today, many oil companies lean very heavily on the seismic method, because this type of exploring has been successful in the past. First the early structures were found, then the more difficult; now the seismic exploration programs are geared to locating the most difficult prospects.

This trend in seismic work has, to a certain extent, brought about a reversal in exploration thinking. Oil companies are learning that stratigraphic plays can be located. Many companies are turning to long-range strat-hole programs as a means of finding this type of production.

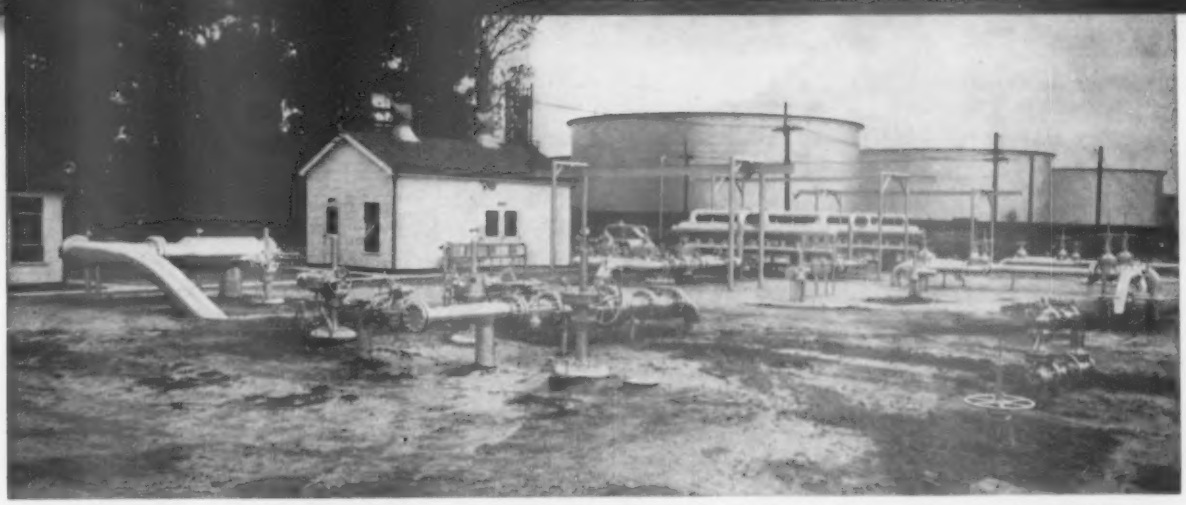
What do all these factors mean to the drilling contractors?

First, it means that money will be spent on drilling, especially on exploratory drilling.

Second, it means that older areas will not simply fade away as they have done in the past, but that drilling will be revived in many of these old areas. Caddo-Pine Island field in North Louisiana is a good example. This is an old field that is now enjoying renewed activity because of the shallow Annona chalk production. North Louisiana's 1954 completions are almost double the 1953 figure because of this activity.

Third, it means that temporarily at least the emphasis has shifted from the deeper expensive plays to the shallower.

Fourth, it means that more drilling contractors will turn to mobile equipment as a possible answer to meet the increasing competition that now faces the entire industry.



Crude-oil meters at Magnolia's Beaumont refinery are now metering about 150,000 bbl. per day of all types of crude. The sliding-vane type meters on four incoming lines are accurate to 0.10 per cent.

Measuring crude on a big scale

How Magnolia Meters a 20-In. Crude Stream

by J. J. Harris

THE accuracy and reliability of positive-displacement meters in crude service has been proved to the satisfaction of personnel of both Magnolia Pipe Line Co. and Magnolia Petroleum Co. The meters are now being used for custody or accounting transfer of crude from several lines, among them a 20-in., and the operation presents fewer problems than comparable products metering.

Gravimetric-type proving equipment has also proved highly successful, particularly on large, 70,000-bbl. per day meters, and provides quick, reliable meter calibrations.

Though Magnolia uses crude meters at several different localities, this article will describe in detail only those operations at Beaumont, Tex., which involve the custody or accounting transfer of large volumes of crude oil—sweet, mixed, and sour—and which require an accuracy of 0.1 per cent or less.

Magnolia Pipe Line has always been interested in improving the accuracy of crude-oil measurements and has worked very closely with many industry committees to this end. It has recognized for many years that tank measurements, particularly in large floating-roof or cone-roof tanks, are subject to considerable errors due to settlement, bottom bulges, changes in liquid gravities, faulty strappings, inaccurate temperature determinations, or other gaging techniques.

In a nutshell . . .

SINCE 1948, Magnolia Pipe Line Co. has utilized flow meters in crude-gathering and main-line operations. Experience at different localities indicates that crude metering in much easier and just as accurate as the metering of refined and L.P.G. products.

In Magnolia's crude operations, three distinctly different types of meters are being used:

1. The **orifice** type meter.
2. The **area** type meter which is commonly known as a rotameter.
3. The **positive-displacement** type meter.

The orifice type meter is used to measure and record instantaneous main-line rates of flow in gross barrels at two of Magnolia's most modern crude stations located at Ringgold and Corsicana, Tex., thereby providing operating personnel with quick visual checks on line conditions. These 16 and 20-in. meters, rated at 1,200 psi. working pressure, have an accuracy of 1 per cent or better and have required little or no maintenance.

Rotameters, 14, 20, and 24 in. in size, are used in conjunction with flow controllers to blend crude oil in predetermined mixtures, which are pumped through Magnolia's two 20-in. lines running from Corsicana to Patoka, Ill., and Beaumont, Tex. One rotameter is used to measure and record main-line rates of flow similar to the orifice meters described above. These meters also have required little maintenance and have an accuracy of approximately 1 per cent. Contrary to some claims, viscosity of the fluid appears to affect the accuracy of this equipment. This type of meter cannot be automatically temperature compensated to measure **net** barrels at this time.

Approximately 20 positive-displacement type meters ranging from 1 to 10 in. in size are used for the following crude-oil operations:

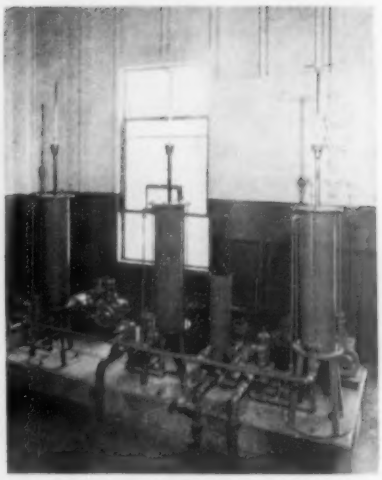
1. To meter all of the crude volume delivered by pipelines, or approximately 150,000 bbl. per day of all types of crude, to Magnolia's Beaumont refinery. This volume is measured in net barrels corrected to 60° F.

2. To meter all of the crude volume gathered at Magnolia's Ringgold terminal and pump station. This volume is approximately 70,000 bbl. per day of Oklahoma and North Texas crudes and is measured in gross barrels.

3. To strap large-diameter tanks, particularly of the floating-roof type.

4. To check the crude runs from small lease tanks.

The 20-in. crude stream from Corsicana is measured by these 10-in. meters which have a capacity of 70,000 bbl. per day each.



Automatic crude samplers used in conjunction with the big-inch meters.

From experience dating back to 1940 in metering refined products and L.P.G., it was realized that meters in many pipeline operations could:

1. Reduce excessive filling and evaporation losses of products.
2. Reduce amount of tankage and, thereby, the capital investment required at terminals.
3. Increase the over-all accuracy of accounting methods.
4. Increase the efficiency of dispatching operations.

With these potential benefits in mind, the first positive-displacement meters in crude service were installed in 1952 at Beaumont on a trial basis. Operating personnel from both the pipeline and refinery checked the operation and accuracy of this installation very thoroughly over a period of several months, obtaining daily meter readings in conjunction with daily gaged tank volumes, both corrected to a 60° F. net basis.

Highly Paraffinic Crude

These meters were 4-in., 300-psi. working-pressure meters and metered approximately 15,000 bbl. per day of East Texas crude oil. This crude is highly paraffinic in nature, having a pour point of 40° F.

A volumetric prover tank, of the type usually found in products-pipeline-meter installations, was used for calibration purposes. The tank was of 16-bbl. capacity and insulated to prevent paraffin deposition. A ¼-in.-mesh strainer and a settling tank were also installed to protect the meters.

This installation was very satisfactory, with an over-all accuracy of less than 0.10 per cent of the throughput and with no operating troubles whatsoever. Monthly inspections indicated that meter wear would be negligible in this type of service.

In early 1953, installation of meters was initiated on two other crude pipelines delivering to Beaumont, one a 10-in. line handling 45,000 bbl. per day of sour West Texas crude and the other an 8-in. line handling 30,000 bbl. per day of sweet South Texas oil. These installations were made principally to reduce pipeline losses caused by voids and leaky valves in the refinery filling lines and manifolds and to reduce the tankage required to measure pipeline receipts. The crude measured by these meters is often delivered directly into the crude stills at the refinery.

Gravimetric-type proving equipment was purchased to calibrate the meters on the 10 and 8-in. lines because of the potential errors in the volumetric method. These errors may result from temperature effects, vaporization losses, liquid volume changes due to pressure, mistakes in reading sight glasses, and tank volume changes due to corrosion or paraffin deposition.

These meter installations including the gravimetric-type equipment also proved very successful. It is felt that the favorable results obtained here were due largely to the scavenging-type inner meter used which protects and cleanses the bottom bearing of the meter.

In late 1953 plans were initiated for a new 20-in. crude line running from Corsicana to Beaumont with metering facilities at Beaumont. Three 10-in. meters, each capable of metering 70,000 bbl. per day, were placed in service on the line in August of this year. The meters are temperature compensated and equipped with totalizers and ticket printers.

Gravimetric proving facilities were also installed. They consist of a 23,000-lb.-capacity lever-type weigh scale which is dial graduated and capable of being read to 1 lb., and a 75-bbl. tank mounted on the scale.

The installation meters approximately 130,000 bbl. per day of five different types of crude, both sour and sweet, and has proved very satisfactory to date.

Accuracy . . . How accurate are the meters at Beaumont? Based upon experience since 1952, crude meters, if properly calibrated, operated, and maintained, are as accurate as meters in products service, or somewhere in the range of 0.05 to 0.10 per cent of the throughput. This accuracy is not automatic but requires a definite metering program consisting of:

1. Adequate calibration facilities and schedules.
2. Periodic inspection, flushing, and maintenance of the meters.
3. Reasonable care and checkup during operation.
4. Ample protective devices such as strainers, air eliminators, settling tanks where necessary, and relief valves.
5. Clear, concise operating and calibrating instructions to field personnel.

A.P.I. Code No. 1101 covering the installation, proving, and operation of positive-displacement meters contains much valuable information on all phases of meter operations. This code

THE AUTHOR

J. J. Harris is the coordinator of crude movements for Magnolia Pipe Line Co. He was graduated from Texas Agricultural and Mechanical College in 1940 with a B.S. degree in chemical engineering. He has been in the employ of Magnolia since June 1940.

Weigh tank of 75-bbl. capacity and 23,000-lb. scale for meter proving.

Sour crude from West Texas is measured through these 4-in. meters. Note settling tank and mechanical totalizers.

needs some revision on the section pertaining to gravimetric proving.

Calibration . . . There has been considerable discussion in the industry upon the calibration of large meters in recent months. Some of the methods in use or contemplated are:

1. Volumetric-type prover tanks with seraphin necks.
2. Gravimetric - type prover which may utilize (a) lever-type weigh scales, (b) strain gages, or (c) pneumatic scales.
3. Large-diameter storage tanks.
4. Master meter method.
5. The "Miracle Mile" method developed by a major oil company. This method involves the running of scrapers through a calibrated section of a pipeline. *(See The Oil and Gas Journal, August 9, 1954, p. 85).*

For Magnolia's crude operations, the gravimetric method is the most suitable of the five. This method offers the following advantages:

1. High accuracy.
2. Few hazards.
3. Little maintenance.
4. Reasonable investment.

In addition, field personnel prefer this type of installation due to the reduction of time and runs required for checking purposes. An installation of this type will cost approximately $3,000 more than a comparable size volumetric type.

No trouble has been experienced with the latest Beaumont installation. It takes on the average approximately an hour and a half to calibrate all three of the 10-in. meters, requiring generally not over two test runs per meter. Line surges have not been a problem. The scales are checked for accuracy by a local factory representative every 60 days. These scales are accurate to 1 lb. from 0 to 23,000-lb. load as shown by actual tests.

It is felt that a Westphal balance reading in **apparent** specific gravity should be used to obtain the crude gravities, which are necessary in the conversion of weight to volume during gravimetric calibrations. Apparent-specific-gravity determinations eliminate buoyancy corrections for weighing in air. A.P.I. gravities obtained with standard hydrometers are not accurate to the degree required in large volume metering and calibration.

Experience with crude meters indicates that one calibration will cover flow rates from 30 to 80 per cent of the maximum range without appreciable error, provided the type of crude does not change. This differs from products metering in which a change of approximately 20 per cent in the flow rate requires a new meter calibration for accurate results.

Five different grades of crudes are being batched through the new 20-in. line to Beaumont. The effect of viscosity on the meter factors is shown in Table 1.

TABLE 1

Crude—	Vis. at 60° F. (S.U.s.)	°A.P.I. gravity	Meter factor
West Texas sweet	35	49.3	1.0002
West Texas intermediate	42	40.5	1.0024
West Texas sour	57	33.8	1.0022
North Texas-Okla. intermediate	61	36.7	1.0018
East Texas sweet	62	38.8	1.0015

The operating practice on the new 20-in. line has been to calibrate the meters on each crude batch in order to accumulate data and to improve measurement accuracy. On some days as many as three calibrations have been made on each meter. On other lines where the type of crude does not change, meters are calibrated on the average every 2 weeks.

Operation and maintenance . . . The operation of meters in crude service presents fewer problems than those in products service in that most crudes offer some lubrication to the meters. This lubrication reduces the need for the stream being metered to be as clean as that required in product metering. Maintenance problems are greatly simplified.

The crude strainers installed at all of the meter settings are ¼-in. mesh compared to the 100 and 200-mesh screens used in products filtration. This size apparently gives ample protection to the meters.

The 4-in. meters first operated in 1952 have metered nearly 3,000,000 bbl. of crude oil each without any maintenance or replacement costs whatsoever. The same lack of wear was also experienced on the two meter settings installed in 1953.

The maintenance program for both products and crude calls for a complete meter inspection every 6 to 9 months regardless of whether or not the meter has shown signs of trouble.

There is nothing that properly trained field personnel cannot understand about the operation, maintenance, and calibration of meters. One man should be assigned to supervise the over-all company-wide meter program. Clear and concise instructions, preferably in writing, should be given to all field personnel concerned prior to initially operating any new metering installation.

Equipment selection . . . Positive-displacement meters can be obtained for any pressure and flow rates normally encountered in crude-pipeline operations, metering volumes ranging from 700 bbl. per day or less to 70,000 bbl. per day each. Auxiliary equipment available includes automatic samplers, temperature compensators, ticket print-

ers, and remote-reading totalizers. Three different types of positive-displacement meters are being used to meter crude; they are the sliding-vane, rotary-bucket, and lobed-impeller types. All of the meters installed to date in Magnolia's operations are of the sliding-vane type.

Sour as well as sweet crude can be metered with standard equipment with no corrosion troubles, if the scavenging-type meter is used.

Satisfactory meter performance, of course, starts with the selection of the proper sized unit for the job. Generally speaking, Magnolia's practice is to install three meters of identical size in a meter setting, any two of which running in parallel will carry the maximum line throughput.

In actual operations, all three units are run at once, thereby reducing wear and tear on the individual meters. This method of sizing also increases the flexibility of the installation without appreciably increasing the cost.

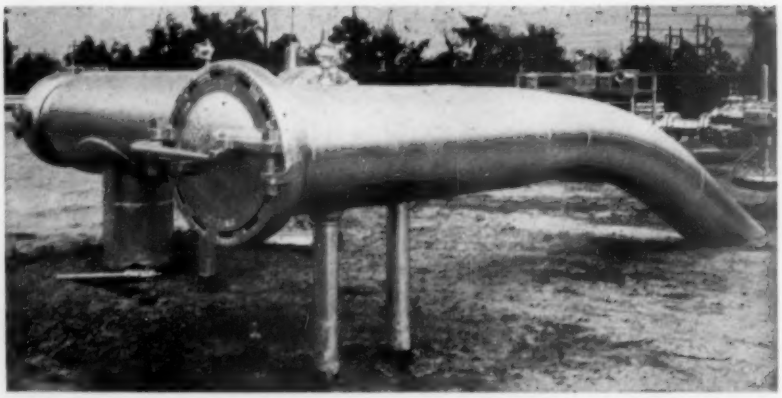
As mentioned previously, ¼-in. mesh horizontal strainers are provided to protect the meters from rocks and other large foreign materials. Where necessary, as in gathering operations, settling tanks and air eliminators are provided in addition to the strainers to prevent damage to the meters. Relief valves are also installed as a safety precaution.

Among other things, the industry needs an accurate, dependable, and simple method for measuring the b.s. and w. content of crudes taken directly from pipelines into crude stills. More accurate and dependable remote transmitting equipment is also required in both crude and products metering operations.

Economics . . . The economics of any meter installation requires detailed study and consideration of many factors. Certainly on any new installation where the tankage investment can be reduced, meters will prove advantageous. It is estimated that the new 20-in. meter setting, installed at a cost of $50,000, saved approximately $500,000 investment in refinery tankage. Where pipeline losses are appreciable, or in the order of 0.10 per cent or more, meters can be economically justified in most cases where 5,000 bbl. per day or more of crude is being handled.

Magnolia's dispatching department would recommend meters on other main lines because of the increased line control and ease in checking shortages. The 20-in. meter installation at Beaumont provides hourly and daily readings whereby the 20-in. crude pipeline is dispatched on a net volume basis, the advantages of which have been recognized in products-pipeline operations for years. For this reason, automatic temperature-compensated meters are preferable in operations of this nature.

There are many locations and situations in crude-oil pipeline operations where meters can be economically justified and used to advantage, particularly where tankage can be eliminated and pipeline losses can be reduced. By following established principles, an accuracy of 0.10 per cent of the throughput can be achieved in metering crude oil with relative ease.



Combination scraper trap and right-angle strainer installed at Beaumont on the 20-in. crude line from Corsicana.

"Sooner than most people think . . ."

A look into the future of crude-oil pipelining might well reveal hundreds of installations similar to this metering and testing layout at Magnolia's Beaumont refinery, the terminus of a 20-in. line from Corsicana. The fact that it's big and new and works well is certainly noteworthy—more important is the fact that this is one more step in the inexorable move toward the ultimate in oil transportation—the completely closed system from well head to refinery.

Impossible? Hardly. It's merely a matter of economics and thought direction on the part of management and technical people. The tools are available today for such a system. Accurate metering and measuring equipment, reliable communication systems, fail-safe automatic controls, and the very desirable technique of centralized dispatching are all being used. Combine them and you have the backbone of the perfect system.

There's nothing really new about the Magnolia installation at Beaumont—the components have been used for years by both the products and crude pipeline industries. What is new is the magnitude of the volume handled—150,000 bbl. per day—and the fact that during a portion of the time the crude stream goes directly into refinery stills, eliminating a half-million dollars' worth of tankage.

What things combine to make the completely closed, perhaps remotely operated system more desirable? Increasing labor costs, the threat of an industry-wide union with strangling power, stronger competition within the industry making it necessary for company after company to increase efficiency through every available means, general trends toward automation, and increasing land values could all accentuate the trend to this type system.

The question of land and space could well be the deciding factor in many cases. Besides the saving in capital investment, Magnolia's Beaumont installation also saved the space necessary for a couple of 120,000-bbl. tanks. This is no small item in crowded industrial areas where most of our refineries are located. Room to build large storage tanks in many of those areas is becoming increasingly harder to find.

While this is not so on the other end of a pipeline, there are still the points of lowering operating costs, increasing system efficiencies, and elimination of losses—all inherent with a closed system.

How soon will it come? That depends, of course, on many things, but primarily on economic necessity. However, it will probably arrive sooner than most people think.

R. G. Deering.

Fig. 1—View of underground storage chamber, taken during construction. (Courtesy National Petrochemicals Corp.).

Fig. 2—View of mined chamber of underground storage of propane, taken during construction. (Courtesy Phillips Petroleum Co.).

AFTER 5 YEARS

Excavated Underground Storage Adaptable To All Types of Petroleum Products

by R. L. Loofbourow

THE rapid expansion in underground storage of petroleum products is due to its economic usefulness, specifically in securely storing large volumes of products at low cost and within a reasonable distance of a desired location. There are four main types of storage for petroleum products, each having its application limited to certain geological surroundings. Excavated storage is one of these type; storage in abandoned mines is closely related.

Capital costs of underground storage are least where natural reservoirs or abandoned mines may be used. Operating costs of these storages are not necessarily least, nor do different types of storage have the same applicability or degree of usefulness.

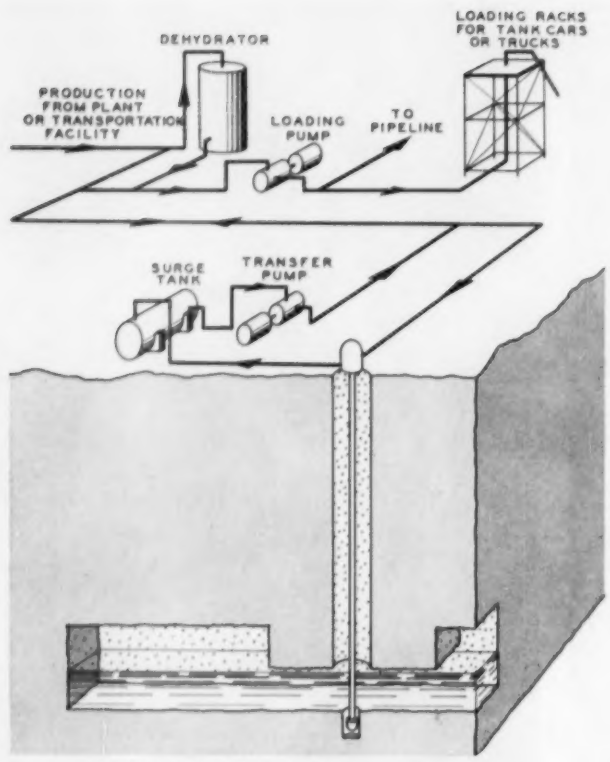
Excavated underground storage has a history of 5 years; it needs further development in site investigation and in means of sealing permeability. It may be used in several geological environments where other types of underground storage cannot, and it is adaptable to storage of gases, liquefied gases and liquids.

The whole field of underground storage as it is now recognized may be classified into four types shown in Table 1. There are at least two variations: (1) there are several natural-gas storages in natural reservoirs which never contained substantial quantities of gas or oil, but which in other ways resemble Type 1, and (2) attempts are being made to wash cavities in hydratable shale following a procedure like that used in Type 3.

This paper is on pressure storage in underground excavations (Type 4), and atmospheric pressure storage in abandoned pits or mines (Type 2); for perspective it contains some information on other types.

Reasons for the extraordinary development of underground storage are basically economic and are generally found under one or more of the following:

The author is consulting engineer, Minneapolis, Minn. Paper presented at Los Angeles A.S.M.E. meeting, September 27, 1954.



FACILITIES FOR HANDLING PROPANE AT EXCAVATED STORAGE

Fig. 3.

(a) Installed costs are lower than costs of pressure vessels or other containers for pressure storage on the surface.

(b) Maintenance costs are lower than those of tankage.

(c) Land requirements are minimum.

(d) A high degree of safety means low risk of damage, loss of product, or interruption of service.

(e) It is possible to store moderate quantities of product operationally, i.e., to facilitate shipment or receipt by barge, tanker, or product pipeline or to smooth any other violent fluctuations of short duration.

(f) It is possible to store large quantities of product seasonally, i.e., during periods or seasons of low consumption for use when demand is high. If storage is near production, waste or distress sale may be avoided; if it is near consumption, transportation facilities may be used at a more efficient rate and a larger or higher grade market may be served.

TABLE 1—TYPES OF LARGE UNDERGROUND STORAGE

Type storage in and first application—	Total present capacity, this type
1. Depleted gas or oil reservoirs by repressuring (pressure storage)—Ontario, 1915:	
Natural gas, M.c.f.	1,300,000,000
Propane, bbl.	2,000,000
2. Abandoned pits or mines (atmospheric pressure)—Sweden, 1949:	
Crude oil, bbl.	1,000,000
Heating oil, bbl.	1,000,000
3. Cavities dissolved in salt domes or beds (pressure storage)—Texas, 1949:	
Propane, butane, ethylene, bbl.	9,000,000
4. Underground excavations usually built for storage (pressure storage)—Texas, 1950:	
Propane, bbl.	525,000

Capital Costs

Table 2 shows actual or estimated costs of constructing various types of storage for several typical products. Where a range of costs is shown, the intention is to embrace conditions varying from favorable to moderately difficult. The actual cost of a particular storage will depend on the effectiveness of testing, design and construction as well as on the:

(a) Cost of engineering at the site.

(b) Cost of access to chambers as determined by the topography and cover required, the nature of the rock through which access will be gained, and the cost of closing such access.

(c) Cost of excavating, partly controlled by the nature of rock excavated.

(d) Cost of any sealing treatment required.

(e) Cost of permanent underground or surface installation desired for pumping, drying, purifying, handling or for storing on the surface.

(f) Cost of rock disposal (rock may have value).

(g) Cost of land.

(h) Cost of labor, supplies, and equipment at the site.

(i) Capacity of the storage.

The spread of these capital costs is perhaps startling, but if representative costs of land were added and the total installed cost converted to an annual writeoff to which maintenance and operating costs were added, then the relative standing of the underground storages would improve.

The difference in the capital costs are an indication why some types of underground storage have grown faster than others. However, if the costs of two storages are being compared, one located so that handling is easy and the other so that it is difficult, the capital writeoff and operating costs of getting the product to and from the difficult location should be included in the cost of using storage at that location. Further, low-cost storage is only

TABLE 2—APPROXIMATE CAPITAL COSTS OF VARIOUS TYPES OF STORAGE ERECTED, WITH MINIMUM HANDLING FACILITIES AT SITE

Type storage—	For oil ($ per bbl.)	For propane ($ per bbl.)	For natural gas ($ per M.c.f.)
Steel gas holder (surface), low pressure			*156
Steel pipe (surface), 1,560 psi.			*48
Liquefaction (surface), atmospheric pressure			*13
Propane pressure vessel (surface)		‡20 to 25	
Small underground excavation		†4 to 10	
Large underground excavation	†2.0 to 4.5	†2.5 to 8	†3.5 to 8.0
Steel tanks, covered (surface), atmospheric pressure	‡1.5 to 2.0		
Cavities dissolved in salt		†0.5 to 2	
Water displacement in abandoned mines (atmospheric pressure)	‡0.1 to 1.0		
Water displacement in sands containing no gas or oil			*0.53
Repressuring depleted gas fields			*0.02 to 0.50

*From U. S. Bureau of Mines, Inf. Cir. 7654, quoting Vandaveer and Schmidt. †Actual cost or estimate by author. ‡Actual cost or estimate by others.

a bargain insofar as it does what the purchaser wants it to do.

What Products Can Be Stored?

In less than 5 years six propane storages of Type 4 have been completed and placed in service. Their capacities range from 30,000 to 270,000 bbl. and total about 525,000 bbl. During this time three other storages were started and abandoned because of unforeseen difficulties. Four storages of this type now under construction are expected to add another 270,000 bbl. of total capacity.

Crude oil . . . Underground storage of heavier hydrocarbons at atmospheric pressure was first accomplished in Sweden where approximately 1,000,000 bbl. of crude oil is stored in an abandoned feldspar mine. A storage for heating oil, recently completed in abandoned slate pits near Wind Gap, Pa., brings the total capacity of Type 2 storage to approximately 2,000,000 bbl.

Petrochemicals . . . Products particularly suited to storage in underground excavations are those which can be reduced in volume by liquefaction at moderate temperatures, those which are produced regularly and consumed erratically, and those which are used in large volumes at a distance from their source. Prime examples are propane and butane. Ethylene is stored in salt "jugs" in one locality.

Anhydrous ammonia, with vapor pressure similar to that of propane, is a likely possibility but its chemical properties and great affinity for water would appear to require that a full study be made to establish noninteraction with rock at a proposed site.

Natural gas . . . This has been stored extensively by repressuring gas or oil reservoirs, but its storage in underground excavations has not been tried. Natural gas can be liquefied only at exceedingly low temperatures at which the behavior of rock masses is unknown. It is quite possible that natural gas could be stored as gas in excavations at pressures of 1,000 to 2,000 psi. The estimated cost of excavating a storage for natural gas, shown in Table 2, is made under this assumption. It is believed applicable to storage capacity in the order of 500,000 M.c.f.

For products which are liquid at ordinary pressures and temperatures the first cost of excavated underground storage does not ordinarily look attractive. But where it is especially important to store large volumes of product in restricted areas, with security and economy, a careful study of underground storage possibilities would appear to be justified.

Picking the Site

Generally a desirable site will be chosen by a supplier or marketer on the basis of markets and facilities for transportation, handling, or producing the product to be stored. Consideration of the same factors will indicate a desired capacity. The function of site investigation is to find a desirable site within this area and to test it sufficiently to indicate whether storage is feasible and at what cost. This may usually be done in steps, a report at the end of each step stating conclusions and recommendations for further work, if any. Steps starting with the easiest may be:

(a) Preliminary study of information available without core drilling.

(b) Preliminary drilling and testing.

(c) Detailed drilling and testing.

The substantial savings which are possible through the use of any abandoned mines will justify a careful examination of any such workings. To be useful, however, they must meet, or be made to meet rigid requirements of which the principal are tightness, stability, capacity, depth of cover, noninteraction with the product to be stored, and provision for the efficient charging and removal of product.

Core drill . . . Since the physical characteristics of a rock determine or limit (a) the size of an excavation which can be made in it, (b) the means which may be used in excavating, and (c) the natural tightness of the rock, including any fractures in it, their determination in advance of construction, though difficult, is of utmost importance. The core drill is the sampling tool. A great variety of tests are to be made on the core and on the walls of the hole; some are commonly used in exploring for oil and mineral, some are used in testing foundations and others must be devised to fit the needs of this type of work or those of a particular project.

An important part of site investigation is to determine the best means of access to the proposed location of the chamber or chambers, and the cost of reaching this location. The cost of shaft sinking or tunnel driving in weak or water-saturated material may be many times the cost of similar work in sound rock, and the cost of access is an important part of the cost of a storage project, especially if the capacity is small.

Stability and Tightness

Many rocks such as loosely consolidated sediments and dense rocks which have been shattered or chemically altered are both unstable and permeable. It is not likely that storage will be excavated in them. Hard, dense, granitic rocks are sufficiently strong to be stable in large openings but must always be suspected of fracture permeability. Weaker, shaly rocks are likely to be impervious but are usually less stable than could be wished. While it is the function of site investigation to evaluate these characteristics and point to locations where they will be least serious, it may never be possible to eliminate both with mathematical certainty, prior to construction. For this reason sound design and cost estimates will be likely to include consideration of remedies for either unstable or permeable rock. Some details are discussed hereinafter.

Excavating for stability . . . Generally small excavations are more stable than large ones, and their unit costs are higher.

The shape of an excavation may be made to increase its stability, by arching the roof, for example, where rock structure permits.

Where stability is in doubt the means used for excavating should be selected so that walls and particularly roofs will be as nearly regular and as little shattered as possible, and so that any required artificial support may be placed with least expense. Control of mining is vital.

The simplest, most flexible and usually the least expensive support for partly stable ground is provided by rock bolts. These are expansion bolts, usually from 4 to 8 ft. long, which tie together thin beds or irregular fragments of rock. They may be used with 6 to 8-in. steel-plate washers against the rock surface or may be used to anchor steel channels, wire mesh, or timber.

Steel props, arches, and concrete are expensive, particularly in large excavations. Concrete may also be undesirable because of its porosity.

Fig. 1 shows storage chambers in rock which is strong enough to stand with no support of any kind; note the arched roof.

Fig. 2 shows a storage chamber cut in rock which required close support, held by rock bolts, on both roof and walls.

Sealing rock permeability . . . All of the excavated pressure storages now in use have been cut in rock which was sufficiently impervious to retain stored propane. Such rock, shales, and sedimentary series in which shales predominate, do not exist in many places where storage might be desired. The following sealing methods have been proposed and the first two have been demonstrated.

In Sweden a large storage for crude oil and an experimental storage for gasoline have been so designed that pressure of ground water, in fractures outside the storage chambers, always slightly

exceeds the hydrostatic pressure of product in the chambers. Thus any leakage is of water into the chambers, and accumulated water is pumped out as necessary to maintain the desired near-balance. These storages are at atmospheric pressure. They have been called "Edholm containers."

Encouraging pilot-plant tests of various sealing compounds have been performed over the last 2 years at Maiden Rock, Wis. Compounds were used to impregnate the walls of a test chamber cut in a very porous sandstone, and a concrete bulkhead, which retained propane.

It has been proposed to seal rock fractures with cement or other grouting material either from the surface in advance of excavating or from walls of the completed chambers. No trial of this is known though grouting is used with more or less success to stop or reduce flow of water into mine workings and under foundations.

A light steel tank could be built inside an excavation and the space between the tank and the rock walls filled with concrete.

More radical proposals have been made and some seem to have promise. It appears that there are a number of different types of leakage and many possible ways of sealing. Conditions at a given location may determine which is most applicable. More information is needed on the effectiveness and cost of these methods.

Design Features

Design elements of excavated underground storage are:

(a) Chambers . . . Chambers must be at such a depth that the greatest operating pressure cannot disturb walls or roof. By rule of thumb, cover should not be less than 1 ft. for each pound of maximum pressure. This is based on the observation that all common rocks have densities of more than 144 lb. per cu. ft. Exceptions are soil, unconsolidated sand and gravel, and rocks of low density such as pumice. Where the charging rate is high with respect to the volume of the storage, the maximum pressure of a vapor cushion should be the vapor pressure at the highest possible charging temperature, rather than at rock temperature. If product is to be displaced, maximum pressure for displacement should be determined and sufficient allowance made.

From capacity requirements and from information obtained in side examination the most effective size, shape and arrangement of chambers may be approximated. This will guide selection of methods and equipment for cutting chambers and for removing broken rock.

For lowest unit costs chambers should generally be as large and as compact as possible without serious effect on stability.

(b) Entry . . . Where relief is low a shaft may be required; in areas of rugged topography access by tunnel should result in lower total costs. An essential and difficult part of planning an entry is the means of closing it. In any case the cross-section of the entry should be kept small. All excavated pressure storage now in use are entered through shafts which have been closed by a concreted or grouted cylindrical steel liner, capped at the surface. Appropriate fittings are provided for a manhole, for pumps, and for measuring temperature and liquid level. Bulkheads are more difficult to make tight but are necessary or desirable under some circumstances.

(c) Product charging and removal—Type 4 . . . Product may be charged through pipe into storage chambers. If it is a gas under pressure, it may be removed by relief of pressure. If it is a liquid and is to be removed as such, it may be removed in one of several ways:

1. By pumping, from shafts, either with deep well pumps or submersible pumps fitted for the product. Either type of pump may be set in a casing the lower end of which is closed by a spring-loaded foot valve so that the pump may be pulled for repair.

2. By displacement, with pumps or gas compressors located outside the storage where they may be repaired most readily. If the chambers are entered by tunnel or by shallow shaft, the displacing medium may be the vapor of the stored product. Water may be used to displace product stored in deep chambers if it has no effect on the walls of the chambers. In either case maximum pressure must be appropriately controlled.

(d) Other handling facilities . . . The requirements for other facilities will depend on the type of product stored, how it is delivered and how it is taken from the storage. Fig. 3 shows a typical installation for propane which is received from a pipeline and placed directly into storage, from which it is withdrawn by deep-well pumps discharging into a surge tank from which it is pumped through a dehydrator to racks for loading trucks or tank cars.

Acknowledgments

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Successful Grease-Making Operation Begins on the Drafting Board

Here are some of the newer trends, and tips on equipment

by O. L. Yarham

THESE are the newer developments that have been coming along in grease making:

- Trends in grease-plant equipment are toward larger, more powerful grease kettles which allow more control of mixing and temperature. The larger mixers are using two-motor drives. Hinged-follower-type scrapers are proving effective for high heat-transfer rates and uniform mixing.
- Increased interest in multipurpose lithium-soap-base greases has brought grease mills into many plants. For other greases, mills are compensating for inferior agitation in the kettle. Manufacturing time cycles have been shortened materially in some cases.
- More interest is being shown in continuous or semicontinuous process equipment by manufacturers who concentrate on large volumes of one type of grease. These installations provide for comparatively rapid throughput and highly efficient heat transfer and mixing.

Grease Kettle and Accessories

The average capacity of modern grease mixers is 2,000 gal. Sizes range from a few hundred pounds to 60,000 lb. capacity. Where 30 to 50-hp. drives were once used for large grease mixers, drives ranging from 60 to 200 hp. are now being used. The use of underpowered poor mixing equipment definitely will result in lower-quality, less-uniform products. Since the grease products manufactured are complex physicochemical systems, the variations in results obtained due to improper control of mixing and temperature are often quite subtle and difficult to interpret.

To be considered successful, a grease mixer should operate for several years with no major mechanical repairs. Among the items which have caused expensive repairs and loss of production time and sometimes waste of materials are gears, bearings, scrapers, and on pressure vessels, leaking stuffing boxes.

Author is associated with Cities Service Research & Development Co., New York. Paper presented at annual meeting, National Lubricating Grease Institute, Kansas City, October 1954.

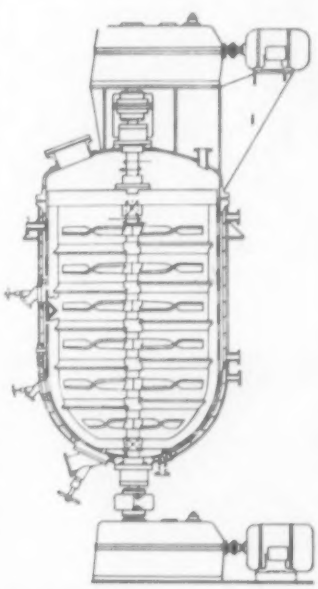
As grease mixers become larger and more powerful it becomes feasible to use two-motor drives instead of one motor. In Fig. 1, one such design is shown. This arrangement resulted in a saving of space at the operating floor level and simplified bearing and shaft seal designs, thus materially lessening the chance of costly repairs. The gear reducers are standard items of manufacture which are rated by the manufacturer for mechanical and thermal horsepower ratings.

Scrapers . . . Scrapers for the inner wall of the grease mixer are necessary to insure reasonable rates of heat transfer, for uniformity of mixing and to avoid local overheating. Leading type scrapers of good design have proved to be reasonably satisfactory but are often susceptible to more wear and repair costs than well-designed hinged-follower-type scrapers. The design of a hinged-follower-type scraper is indicated in Fig. 2.

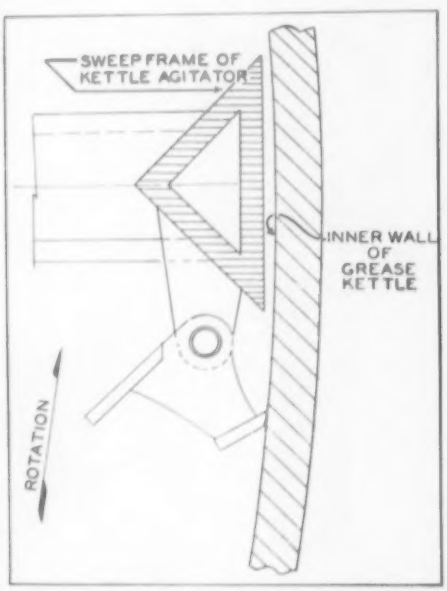
While many single-motion agitators are giving excellent performance on some greases, experience has proved the superior performance of double-motion agitators. Not all double-motion agitators enable satisfactory mixing. Some designs allow excessive channeling during critical heavy soap stages as the agitator bars are too far apart. Despite slow, careful addition of oil, some high-soap content, high-viscosity material will adhere to agitator bars while the main mass of the material is diluted with oil and softened.

By the time some of this material falls off the bars, the main mass has become so diluted that the viscosities of the two portions are so far apart that only a gross type of uniformity may be obtained and critical control of the necessary fine degree of dispersion or gel structure may be lost.

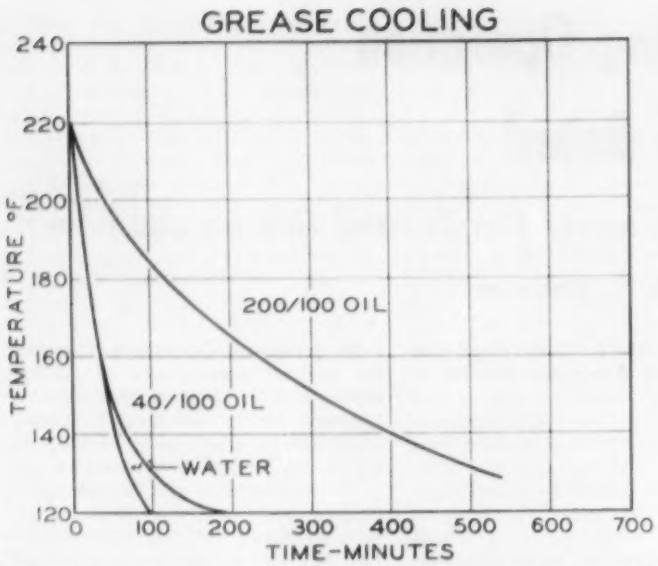
In design, a balance must be reached between the need for a streamlined agitator and the bulk necessary for the structural strength. For double-motion agitators, experience has proved that closely spaced agitator bars with only about as much space between agitator bars as the projected area of one of



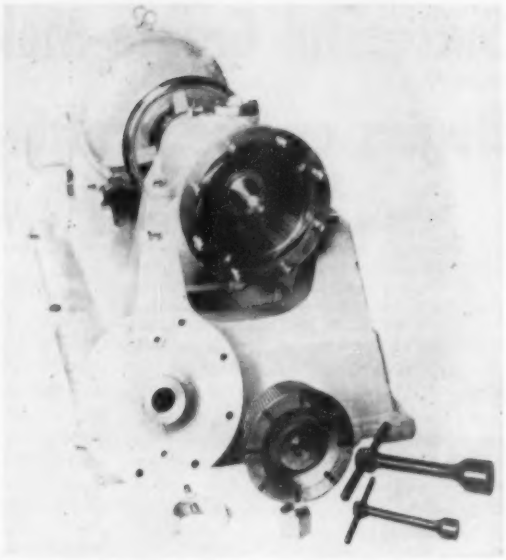
TWO-MOTOR DRIVES are currently being used for the larger grease mixers. Fig. 1.



HINGED-FOLLOWER-TYPE scrapers for inner walls of grease mixers insure good heat transfer and uniform mixing. Fig. 2.



LOW-VISCOSITY mineral oil has better cooling characteristics than the high-viscosity material when used as heat-transfer medium in jacketed kettles. Fig. 3.



THIS GREASE MILL with hardened steel rotor and stator is used in making a variety of greases. (Photograph courtesy Chemicolloid Laboratories, Inc.). Fig. 6.

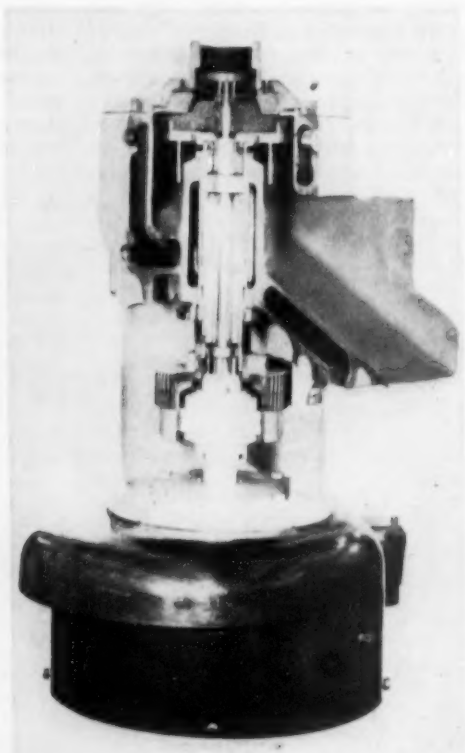
the bars in the vertical plane has been best.

Jacketed mixers . . . While many direct-fired grease mixers are still in use, most of the recent installations are jacketed. Usually some cooling is needed and when steam is the heating medium, water is used for cooling. A typical jacket working pressure is 150 psig. With a properly insulated closed-top grease mixer including wall scraping and good agitation, saturated steam at this pressure will give grease temperatures up to 350° F.

While this temperature is adequate for most grease processing, from 380° to 410° F. top temperatures are used for best results in some plants processing multipurpose lithium greases. One of the complex strontium soap-type greases requires a temperature of 500° F.

Circulating hot mineral oil has been used as a heating medium in a few plants for several years and is becoming increasingly popular. With hot oil used as the heating medium, it is evident that water cannot be used in the same jackets for cooling. In one grease plant using 200 S.U.s. at 100° F. oil it was found that satisfactory cooling rates in the kettles could not be obtained. This problem was solved by using a thermally stable oil with a viscosity of 40 S.U.s. at 100° F. Fig. 3 shows the time saved in cooling grease compared with the more viscous oil. The lower viscosity oil is used up to 425° F. for heating.

SOAP-COOKING TIME can be reduced by this type of contactor. (Photograph courtesy Stratford Engineering Corp.). Fig. 4.

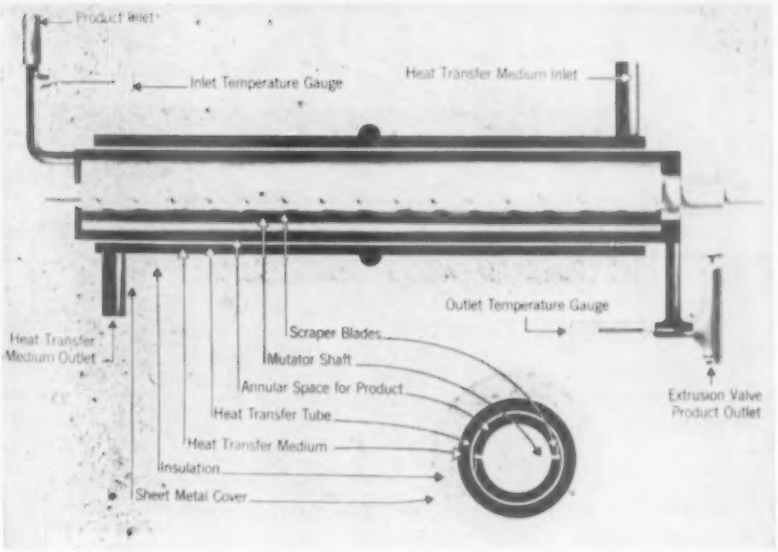


HIGH-SPEED MILLS like this are now being used in many grease plants. (Photograph courtesy Morehouse Industries). Fig. 5.

Equipment for Soap Formation

For economic reasons and for quality control reasons, the lubricating grease manufacturer makes most of his own soaps. By the use of equipment illustrated by Fig. 4, soap-cooking time has been reduced as much as 2 hours compared to open-kettle cooking. It is necessary to provide cooling for this equipment to enable charging of successive batches.

Grease pumps . . . In many plants, pump failures have been a major item



CONTINUOUS GREASE PLANTS such as this provide for high heat transfer and coefficient mixing. (Photograph courtesy Girdler Co.). Fig. 7.

of expense and the cause of delays. Among the mistakes made in the installation of grease pumps are:

1. Excessively long suction piping of inadequate size.
2. Discharge piping too small or too long.
3. Failure to use a self-cleaning type of strainer on the discharge side of the pump rather than an ordinary screen.
4. Pump is driven too fast for its design or is too light in construction for heavy-duty service.
5. A type is selected which gives one or two pulses per revolution and thus causes excessive vibration to piping and other equipment.
6. Relief valves of close compact design are not provided.
7. Lines are not h e a t e d where needed.

In the selection of pumps and the design of grease piping, previous plant experience is the best source of information. Simple formulas are available from which pressure drop can be estimated knowing viscosity, or viscosity may be estimated from pressure drop.

Since atmospheric pressure (14.7 psia.) is the only force, other than slight static head pressure, which can cause grease to feed to a pump, piping conditions on the suction side of the pump are quite critical.

Grease milling . . . While milling of grease has been a part of some manufacturers' operation for many years, increased interest in multipurpose lithium soap-base greases and in some of the nonsoap thickened specialty lubricants has brought mills into many plants.

Two types of high-speed mills are used in many grease plants. The internal construction of one mill using specially prepared stones for the rotor and stator is illustrated in Fig. 5.

The construction of another type of mill also in successful use on a variety of greases is shown in Fig. 6. This machine has a hardened-steel rotor and stator.

Another type of mill consists of a high-pressure triplex piston-type pump which forces material through an adjustable opening of small size. The material flows through the opening at high velocity and impinges against a hardened-alloy ring. This causes an intense action on the product.

Pilot-size units are offered in all three types of mills. Mills are necessary in the processing of some greases. For other greases, mills will compensate for inferior agitation in the kettle. Manufacturing-time cycles have been shortened materially in some cases. Other greases cannot be improved by milling if properly kettle processed.

Milling will not always compensate for improper processing up to the point of milling, nor will it make good greases out of inferior formulations.

Continuous Equipment

Complete compact continuous grease plants are available for the manufacture of aluminum stearate and lithium greases. These plants have been designed around a highly efficient heat-transfer and mixing machine which is illustrated in Fig. 7. The manufacturer reports that the capacity of a Votator aluminum stearate grease plant is approximately 1,500 lb. per hour; for lithium grease, the rated capacity is 2,000 lb. per hour.

Materials handling . . . As the materials other than mineral oils which make up the finished grease amount to only about 10 per cent of the product, on the average, it could be expected that handling of these materials should not be a major problem.

Pamphlets giving excellent advice on the handling and storage of liquid and semisolid fats and fatty acids are available from many of the suppliers of these materials. To avoid contamination, a completely isolated system consisting of a separate tank, pump, weigh tank, and piping should be provided for each separate material. In plants where this simple rule was not followed, a tremendous amount of difficulty has been encountered.

While a slight amount of contamination among some of the mineral oils used may not be as serious as contamination involving fats and fatty acids, the same general rule should be used in handling mineral oils.

Container storage, preparation, filling, and handling can amount to the largest item of labor expense. Bulk handling of finished greases has materially reduced costs in plants handling large volumes of greases. An excellent discussion of bulk handling and other solutions to materials handling problems in packaging grease was published in the Institute Spokesman, April 1952.

The Completed Plant

A successful grease-manufacturing operation is possible only if the equipment is good and the complete installation carefully planned. Successful operation and good housekeeping begin on the drafting board, or earlier.

The pilot plant . . . As it seems logical to make mistakes on as small a scale as possible, the lubricating-grease industry may find it advantageous to do more exploratory work on a pilot scale. Some companies are now doing interesting development work on a small scale. It is probable that improved equipment and methods of processing greases will result.

Increased labor costs are being faced by all industry and the lubricating-grease industry is no exception. Man has been rated mechanically at about one-sixth horsepower. The cost of one-sixth horsepower-hour (one man-hour) of mechanical work done by man is about $3 in production work. If an electric motor can be installed to do this work, this same amount of mechanical work will cost about one-third of a cent.

It is thus understandable that grease manufacturers are finding it necessary to eliminate hand labor where possible. It is believed that this trend will continue, and that the manufacturer who can most successfully apply mechanical equipment will enjoy a distinct advantage.

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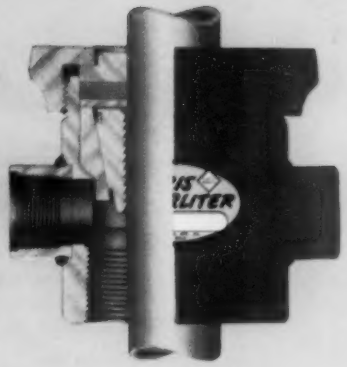

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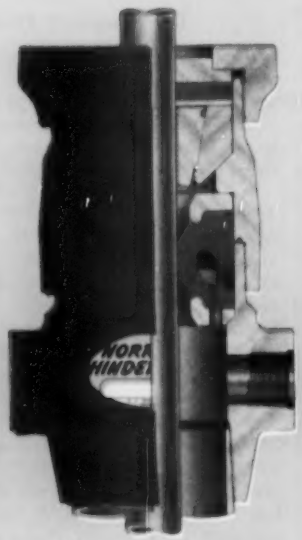

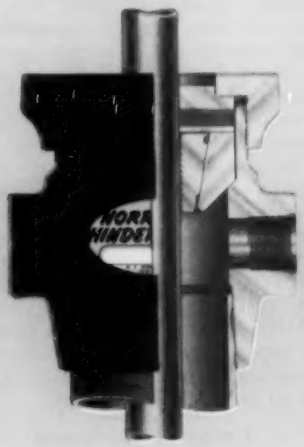

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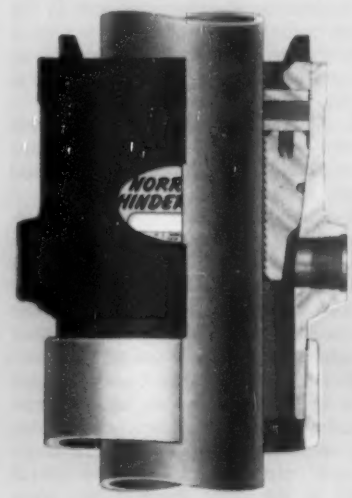

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What's the Life Expectancy of Your DRILL PIPE AND TOOL JOINTS?

by John Rhea

IT would be impossible to make recommendations that would hold true for any and all situations regarding what type tool joints or pipe a drilling contractor should use. It would be equally impossible to recommend whether or not it should be hardfaced or whether the contractor should try to effect economies by rehardfacing, rejointing or reusing his tool joints. On the other hand, however, each one should recognize the economics involved in his own specific situation regarding his program of usage and retirement of his drill pipe and tool joints.

Author is with Southeastern Drilling Co., Dallas. Paper presented at annual meeting, A.A.O.D.C., Los Angeles, October 11, 1954.

Needed—A Yardstick

IN February 1954, a subcommittee was formed under the auspices of the rotary drilling committee of the A.A.O.D.C. for the purpose of gathering specific information on the wear and usage of drill pipe and tool joints in the various areas. A questionnaire was sent out to various users of drill pipe in the different sections of the country. The answers to these questionnaires, plus information gained by the members of the subcommittee in discussions with the users of drill pipe, have been accumulated and is the information contained in this article.

Complete information is not available because too few contractors keep adequate records of the actual service they obtain from their drill pipe and tool joints. Another important reason is that so many variables enter into the service which a string of pipe or joints will give that it is very difficult to generalize.

There is a wide divergence of opinion regarding the units that should be used to express the service life of drill pipe and/or tool joints. The subcommittee has no recommendation to make as to the unit the industry should standardize upon, but studies upon this subject would be greatly facilitated if some unit could be chosen as standard.

There is a difference in the price of the drill pipe itself on to which hand-applied tool joints are installed, and on the other hand, on to which flashweld joints are installed. In addition, there are differences of prices in the different types of tool joints. All of these differences add up to the fact that the unit cost per foot of a certain grade of pipe with hand-applied joints will cost slightly more than a string with flashweld joints.

The question of just which type string would be more economical must be answered by each contractor for himself. Past the point of purchasing the original string of pipe and joints, the decisions involving whether or not to rehardface or rejoint, or to retire the string of pipe, should be answered with the consideration of the economics for the individual contractor operating in his specific area.

Presented here are some general observations that may serve as guides in these areas: the Gulf Coast; California; Oklahoma; Kansas; Illinois; and the Permian basin of West Texas and New Mexico. Most of the wear figures in the following reports are average or general figures for those respective areas and should not be termed as fitting any one specific spot, or any one particular contractor.

Gulf Coast Area

In Gulf Coast operations, service obtained from tool joints and drill pipe is about the same among the many users and over the entire area. Upon 9⅞-in. holes ranging in depths from 10,000 to 14,000 ft., either 4½-in. o.d. or 5-in. o.d. drill pipe will drill an average of 300,000 to 350,000 ft. of hole. Nonhardfaced, standard o.d. tool joints will only last for approximately 100,000 ft. of hole; and, therefore, most of the tool joints bought for use in this area are hardfaced in the shop at the time of purchase.

Most of the tool joints used in the area are oversized as well as being hardfaced. At the point at which the original hardfacing becomes worn thin, a field reapplication of tungsten carbide is made and from each of these reapplications an additional approximately 100,000 ft. of hole is added to the life of the tool joint. By this procedure, maximum life is obtained from both pipe and joints at the lowest cost.

No resleeving of tool joints is done in this area; and the reports are that tong die expense upon hardfaced joints is approximately three times as great as that upon nonhardfaced joints. No wear figures have been obtained upon 3½-in. o.d. drill pipe since this size pipe is used primarily for completion operations, or for drilling through long strings of 7-in. casing on the Gulf Coast.

California

Information received from a large segment of the drilling industry in California indicates the following main points:

1. All drill pipe outwears the tool joints.

2. Upon wells of an average depth of 8,000 ft., 4½-in. drill pipe will last for 200,000 ft. of hole, but the normal life of standard o.d. hardfaced tool joints is only 100,000 to 175,000 ft. of hole. Therefore, the general practice is to rehardface the tool joints at least once, and from this improvement, an increase in the life of the tool joints of 40,000 to 60,000 ft. of hole will be had. The drill pipe and the tool joints will wear out about the same time after one reapplication of the hardfacing.

3. The usual life of 5-in. o.d. drill pipe is only about 150,000 ft. of hole as compared to 200,000 ft. of hole for the 4½-in. o.d. drill pipe.

4. Fifteen per cent of the California contractors use resleeved tool joints and report that the service had from them is practically the same as that from new tool joints.

Kansas

For usage in drilling the relatively shallow wells of Kansas averaging in depth from 3,200 to 3,500 ft., both the drill pipe and the standard o.d. nonhardfaced tool joints have a service life of approximately 150,000 ft. of hole. Very little hardfacing of tool joints is done in this region and when it is applied, it is usually for the purpose of restoring the o.d. of used joints. Very few tool joints need to be replaced upon a string of pipe since usually the pipe and the joints wear out about the same time. This is true even though part of

the drill pipe string is usually run in compression.

Illinois

The formations encountered in Illinois are probably the most abrasive in the United States with the possible exception of the Delaware basin. The average life of drill pipe in this area is about 90,000 ft. whereas the average life of oversized hardfaced tool joints is only about 45,000 ft. Therefore, the general procedure is to rejoint the pipe at least once and in many cases it is rejointed twice. Because of the fact that the pipe is always rejointed at least once, 95 per cent of the tool joints used in the area are of the hand-applied type.

The general practice seems to be to run at least part of the string of drill pipe in compression as only very few drill collars are used. It would seem that this fact in part accounts for the extremely high rate of wear upon the tool joints. The resleeving of tool joints is not practiced here at all.

Oklahoma

For any discussion upon tool-joint and drill pipe wear, the Oklahoma area must be divided into two parts. In southern Oklahoma the average life of 4½-in. drill pipe varies from 100,000 ft. of hole drilled to 125,000 ft. In some isolated fields it does not last even this long because of corrosion fatigue.

Generally speaking, an oversize 6-in. o.d. hardfaced tool joint is installed on new pipe, and to wear out the pipe and the tool joint, two or three reapplications of the tungsten carbide are required. Some operators, instead of reapplying the hardfacing material, replace the tool joint with another 6-in. o.d. hardfaced joint in order to wear out the string of pipe. The practice of retiring the pipe and joints in southern Oklahoma is somewhat similar to the practice followed in the Gulf Coast.

In northern Oklahoma the formations are not as abrasive and show about the same wear characteristics as those found in Kansas. Both 3½-in. o.d. and 4½-in. o.d. drill pipe will last from 120,000 ft. of hole to 150,000 ft. and a standard o.d. nonhardfaced joint will retire the pipe.

Permian Basin of West Texas and New Mexico

Two factors in particular distinguish the Permian basin from other areas, when considering tool-joint wear. First is the relative lack of abrasion in drilling the lime, shale, and dolomite formations. Ordinarily tool joints may be expected to last longer than drill pipe.

Secondly, although the life of drill pipe is related to the tool joint life to some extent, the life of drill pipe is erratic due to corrosion fatigue. Thus, the best planned program for utilization of tool joints may be suddenly spoiled by untimely demise of the pipe. For the same type operations the life expectancy of 4½-in. drill pipe was reported as 65,000 ft. of hole drilled in one case, and 225,000 ft. in the other.

In considering the figures in the summaries submitted for the Permian basin, it should be remembered that they are averages only. Probably the most reliable data submitted are those for 3½-in. and 4½-in. drill pipe used in 7⅞-in. and 8¾-in. holes. These figures represent averages for a greater number of operators.

Probably the most useful thing noted from the study in the Permian basin is the relative uniformity of wear rates reported for tool joints. Even though it was difficult for operators to predict ultimate utilization of their tool joints due to uncertainty of pipe life, a study of available data showed remarkable uniformity of wear rates among various operators for the same type service. This can be helpful in that an operator can predict fairly well the remaining useful life in a string of tool joints.

Average figures for various types of service with nonhardfaced tool joints are as follows:

1. Drilling 11 and 12¼-in. intermediate holes from the surface to approximately 4,500 ft.—
   5½-in. tool joints—0.0037 in. per 1,000 ft. of hole
   4½-in. tool joints—0.0050 in. per 1,000 ft. of hole

2. Drilling 7⅞ and 8¾-in. holes—from intermediate casing point to 10,000-13,000-ft. depths:
   4½-in. tool joints—0.0031 in. per 1,000 ft. of hole
   3½-in. tool joints—0.0025 in. per 1,000 ft. of hole

As an example of how these figures turn out, an operator who purchases new 6-in. o.d. tool joints for 4½-in. drill pipe and expects to retire them when 5¼-in. o.d. will be able to wear ¾ in. off the diameter of his tool joints. Footage may be predicted as 0.750 in. divided by 0.0031 in., or 242,000 ft. Should he have a string of tool joints worn to 5⅞ in., that he desires to salvage, he can expect another ⅞ in. wear, or 101,000 ft. From these same figures the economy of purchasing oversize tool joints can be estimated. The additional ¼ in. on the diameter can be expected to add 80,000 ft. of service to tool joints for 4½-in. drill pipe.

Hardfacing practice . . . Tool joints hardfaced by the manufacturer are utilized by many operators. They can expect to effect economies by wearing out two, or even three, strings of drill pipe with a single set of tool joints.

Field hardfacing of new tool joints is not a regular practice in the Permian basin. It is often used, however, to extend the life of tool joints to equal that of a second string of pipe. Occasionally, an operator may need this type service to extend his tool joint life on unusually good strings of pipe.

Outside the basin . . . Another factor that often upsets a Permian basin operator's plan is the drilling of wells, with his regular equipment, outside the basin proper. A matter of only a few miles outside the basin can make a great deal of difference in the abrasiveness of formations. Deep wells in the Delaware basin to the west are extremely abrasive. Also, the Edwards plateau area to the south, and the West Central area on the east are considerably more abrasive than the Permian basin proper.

No one in the Permian basin has reported having used resleeving of tool joints to resist abrasive wear. Tong-die expense on hardfaced tool joints is three times as great as nonhardfaced tool joints according to an average of eight definite replies to this question.

Inside coating effective . . . Only two operators had enough sufficient statistical information from which to report definite results from a program of coating the inside of their drill pipe with plastic and thereby lengthening the life of the pipe. One operator increased the life of his 5½-in. o.d. drill pipe which is used to drill 11 and 12¼-in. intermediate holes from 40,000 ft. of hole drilled to 140,000 ft. of hole drilled. During the course of drilling this 140,000 ft. of hole, the pipe had to be recoated two or three times, but even so, this particular program was an obviously economical improvement.

Another operator maintains plastic coating on the inside of all of his drill pipe used in the Permian basin. This includes 3½, 4½ in. and the larger sizes of pipe for drilling the intermediate hole. Although he reported no specific footage figures, he did report that generally speaking, his drill pipe life has been approximately doubled by the plastic coating.

Chromates used . . . Another method by which an extension in the life of drill pipe is attempted is the maintenance of a certain concentration of chromates in the mud system. This chemical's presence in the mud stream is theoretically effective in combating electrolytic corrosion. At least one operator used chromates on a constant, continuous program, but no definite data on the benefits obtained are available.

IT'S "EDUCATED GUESSING"

A look at the various methods of

Estimating Natural-Gas Reserves

by Ralph E. Davis

Approximately 80 per cent of all estimates being made today are by the volumetric method, and the author describes the procedure used in this method

ESTIMATES of gas reserves are a controversial subject. Two approaches to the reserve problem are in common use in gas studies: one the so-called volumetric method, where we deal with the volume of the reservoir yielding the oil or gas; and the production versus pressure-decline method, where expected future production is related to past production and the resulting pressure decline.

Early history . . . Prior to about 1915, very few estimates of oil, and probably none of gas reserves, were made. In those years, geologists were not prepared to render the extremely consequential service to the oil and gas industry rendered today. True, the relation of anticlinal structure to pools of oil and gas had been recognized. This relationship was first pointed out by Henry D. Rogers in 1860, and noted by others from time to time.

The U. S. Bureau of Mines was established in 1910 and gave early serious attention to the behavior of oil wells. The bureau was vitally interested in the waste of gas in the production of oil. Its investigations covered a broad field, and bureau staff members made notable contributions to the study of estimates of oil reserves. The more prominent of these men were J. O. Lewis and Carl Beal. They laid the foundation for scientific appraisal of oil properties.

Author is consulting geologist, Houston. Paper was originally presented before the Independent Natural Gas Association of America, New Orleans, September 14, 1954.

Washburn was first to suggest what he called the "saturation" method. Lewis and Beal stressed the production versus time decline curve method as most reliable. Earlier estimates had been made by the "production per acre method," which simply compared similar properties, and judged new fields by the actual production of largely depleted fields.

Prior to about 1920, very little work had been done in the field of estimating gas reserves. In those days engineers relied upon production-decline curves to a great extent. Much of the early work was related to depletion for income-tax deductions. And that meant generally a determination of reserves under individual tracts, and frequently beneath an individual well.

No really long-distance gas lines were built before 1925, and except in Canada, there was no public financing for those that were built. Gas had been found in abundant quantities in certain areas, such as in Lewis and Harrison counties, West Virginia, or in the Clinton sand area in Central Ohio. Gas lines were built when the management of a company decided that there was enough gas **up that way.** And as the fields were gradually depleted, deeper drilling or extensions of the lines into neighboring areas maintained the annual flow of gas.

In those early years, it was difficult to make an overestimate of reserves. As production declined, "extensions and revisions" as defined today by the reserve committee of the American Gas Association, served to increase the previous estimate. Furthermore, the lowering of the intake pressures of the gathering lines brought out more gas than the decline curves indicated.

Estimating associated gas reserves . . . The close association of gas with oil—the production of gas from a reservoir where it is present in oil or associated as gas-cap gas—frequently makes it essential to study reserves of oil in order to estimate the gas. In California, approximately 75 per cent of the gas is dissolved in oil or is associated with oil in the reservoirs. In West Texas, approximately 90 per cent of the gas now known is dissolved in, or is associated in the reservoirs with oil.

In the United States, about 15 per cent of proved gas is dissolved in oil, another 15 per cent is associated with oil in the reservoirs. Thus about 70 per cent of our estimated proved recoverable gas reserves of 211 trillion cubic feet at the end of 1953 is in reservoirs essentially void of oil.

The estimation of reserves of gas dissolved in oil and produced as casing-head gas can be mentioned at this point. The essentials are an estimate of total oil in the reservoir, the gas in solution under reservoir conditions—

"Methods followed should be the one best suited to information available."

the total expected oil production, and the gas produced with the oil. Engineers endeavor to estimate the total oil that will remain in the reservoir and the quantity of gas that will be retained in solution under the condition of abandonment pressure; and the quantities of gas that will have been liberated from the oil as pressure declined but retained in the reservoir space voided by oil or oil and water. In many fields, pressure maintenance results from returning a portion of the casing-head gas to the oil reservoir. When one is interested in the gas reserve of such fields for eventual delivery into pipelines, the problem of recovery is of great significance. Roy Bauer, who is very familiar with these problems in California fields, estimates that of the total producible casing-head gas of that state, only 45 per cent can be expected to eventually reach pipelines for distant delivery, whereas of the dry-gas production of the state he estimates pipeline gas at 85 per cent of that brought to the surface.

It must be evident to all of us that in dealing with casing-head gas reserves, care must be taken to avoid overestimates of gas available to pipelines.

Estimating nonassociated gas reserves . . . The oldest of all methods is judging gas in a newly found reservoir by comparison with neighboring fields considered essentially similar. This method frequently is useful to some degree. In judging reserves in a newly productive area, with but a few scattered wells and no production history, engineers may be influenced by the acre reserve estimates in neighboring pools producing from the same sand. Naturally they are guided by the sand thickness, the porosity, the connate water, the permeability, the pressure and temperature, etc., of the new reservoir. These arithmetic factors, however, do not tell the whole story—and for the reason that certain of these factors are based upon samples which represent only about 1 part in more than 100,000,000 parts of the reservoir. In other words, in considering reserves in a Berea sand pool in West Virginia, or an Oriskany sand pool in Pennsylvania or a Miocene sand pool in South Louisiana or an Ellenburger pool in West Texas, engineers have regard to the history of production per acre and per acre-foot from older depleted fields similar in type.

The Pressure-Decline Method

The pressure-decline method is widely recognized as highly reliable. This method is based on the relationship of expected production to past production on the basis of percentage pressure decline. Generally it is not feasible to use this method during the early few years of production, mainly because a sound trend is not developed so soon. Usually, we do not know the area of the pool, nor how significant the pressure declines may be from possibly only a few wells.

Past experience has clearly shown that the method must be used with great care. Not only must one guard against error in failing to sense the effect of a water drive, but he must also be careful not to use erroneously the effect upon average pressures by the pressures of new wells.

The Volumetric Method

This method is extremely important, because it is practically the only analytical method that can be used in newly discovered fields. And that generally is the time when estimates are needed. Approximately 80 per cent of all estimates being made today are by this method.

The procedure in using this method is widely known and generally recognized. The completeness of the information and its accuracy are of course fundamentally important. The thickness of the pay may be determined from a few—or many wells—from cores—or from electric logs—or from such information as has been acquired during drilling. If oil and gas reservoir rocks were uniform—as to thickness, porosity, permeability—these determinations would be relatively easy. But generally it is necessary to develop a structure map—maybe for each of several sands. And frequently, especially in deep Gulf Coast fields, the fault pattern is difficult to fathom.

It frequently is a laborious detailed study that involves months of work. And the intricacy is often such that no two competent men can agree and be sure. To determine the thickness of the pay, it is common to prepare isopachous maps. That requires experience, judgment, and careful study of detail. The proper preparation of the isopachous map may be in part dependent upon the proper preparation of the structure map.

So here again competent men may disagree. This work must be entrusted to men who are highly qualified as to training, experience, patience in detail study, and possibly most important of all, an instinct developed in them to try to do an honest job.

Factors involved . . . The volumetric estimate is the result of a calculation of the size of the reservoir and of the known gas-containing space within it. The calculation follows this sequence:*

(a) The gross volume of reservoir rock containing gas is computed areally, in acres, with thickness expressed in feet, and the size of the reservoir stated in units of acre-feet, or cubic feet. Geological information as to the magnitude of the structure and the limits of gas accumulation within it is needed. Structural and isopachous maps of the reservoir must be prepared based upon geological logs of the formation penetrated, electrical logs, and core analyses. The results of tests of the sand made to determine its productivity are also generally required. Some sections of the reservoir rock may be eliminated because porosity or permeability are too low, or because too large a percentage of interstitial water is present. The remaining reservoir rock is considered to be commercially producible, and is classified as the pay thickness, measured vertically in feet.

(b) The gross volume of the pay, measured horizontally in acres and vertically in feet, has varying degrees of porosity in its different parts. The average porosity of the pay is ascertained from information available. The acre-feet of pay are converted to cubic feet and multiplied by the average porosity of the pay section to yield a product that represents the total volume or space containing reservoir fluids, expressed in cubic feet.

(c) Oil and gas reservoirs generally contain water, which adheres to the sedimentary grains in quantities primarily related to the physical and chemical character of the sediment. Based upon physical laws, it may be inferred that the interstitial water is less in gas than in oil reservoirs. Information regarding this point is meager. It is necessary to deduct the connate or interstitial water from the volume of total pore space before arriving at the net volume of gas-containing space. The total quantity of gas contained in this pore space or reservoir is directly related to the reservoir pressure. Corrections are made for temperature and deviation from the assumed "ideal gas" behavior before arriving at the quantity which the reservoir contains.

The customary volumetric formula used in estimating gas in place may be expressed as follows:

*The following explanation of the procedure in application of the volumetric method is for convenience, taken essentially from a paper, "Appraisal of Natural-Gas Properties," by Ralph E. Davis and Dr. Eugene A. Stephenson, presented at the annual meeting of the A.I.M.E. in January 1953.

$$V = 43{,}560 \times A \times S \times P \times (1 - C) \times P_r/P_{mb} \times T_{mb}/T_r \times 1/Z$$

where:

- V = volume of gas in the reservoir, in cubic feet, at pressure P_{mb} and temperature T_{mb}.
- A = proven area, in acres.
- S = average net effective pay thickness, in feet.
- P = porosity of the pay usually expressed in per cent.
- C = connate-water content of the pay usually expressed in per cent.
- P_r = reservoir pressure in psia.
- P_{mb} = pressure measuring base in psia.
- T_r = reservoir temperature in °R. (Fahrenheit pus 460°).
- T_{mb} = temperature measuring base in °R.
- Z = deviation of the gas from ideal gas behavior.

43,560 is number of sq. ft. per acre.

The foregoing discussion indicates the fundamental importance of geological knowledge in making estimates of gas in place by the volumetric method. Virtually every significant step taken in the calculation of the space within which gas is confined requires an act of judgment based on geological and engineering evidence. Errors in judgment, as well as in data, can result in grossly inaccurate estimates.

(d) **The recovery factor.** Only a portion of the gas contained in the reservoir will ultimately be produced. It is necessary to determine a recovery factor, or percentage of the gas which will likely be produced during the economic life of the property.

Determination of the recovery factor depends largely upon a consideration of the factors discussed above. But physical factors alone do not determine the ultimate recovery. Proration regulations imposed on some fields by state authority may affect the recovery from a particular property. Economic influences, such as price and markets and the costs of development and operation, must be considered. Furthermore, changed economic conditions in the future can modify today's judgment. In the final analysis, the recovery factor is estimated after consideration of the net interplay of physical, regulatory and economic forces, many of which may be known imperfectly.

A study of many depleted or nearly depleted fields* indicates that under average conditions about 85 per cent of the total gas in place will in dry-gas reservoirs be recovered. The amount in any case is dependent upon an interplay of many factors, of which the permeability of the reservoir rock is the major one. The recovery may reasonably be estimated as low as 50 per cent to 60 per cent or higher than 95 per cent. In each case the suitable recovery factor must be determined.

*Ralph E. Davis and L. H. Meltzer, "The Availability of Natural Gas," presented at the Petroleum Branch A.I.M.E. fall meeting, Houston, October 1-3, 1952.

ESTIMATED RESERVES IN BILLION CUBIC FEET

	Estimator A		Estimator B		Estimator C	
	Volumetric	Pressure decline	Volumetric	Pressure decline	Volumetric	Pressure decline
Initial gas in place	960	929	1,165	1,177	1,287	1,116
Recoverable gas, January 1, 1953	529	506	738	750	Not given	

Reliability of Reserve Estimates

Every estimate is to some degree approximate. Some are certainly more dependable than others. Basic data are frequently somewhat meager — sometimes difficult to evaluate—sometimes contradictory.

A few examples may illustrate the problem. In 1953, in a hearing before the Alberta Oil and Gas Conservation Board, three presentations were made relating to the recoverable proven reserves of the Viking-Kinsella field. Three nationally known firms presented their estimates. Each used both the volumetric and the pressure-decline methods. These figures are shown in table above.

Or another example. In 1954, three estimates were presented before the Federal Power Commission in a hearing dealing with gas reserves available for a certain proposed long-distance pipeline. The estimates were based upon complete data available to all three persons. The estimates were:

Estimator	Gas available (billion cu. ft.)
A	3,200
B	1,600
C	865

Admittedly these examples are chosen from among those showing a wide divergence in estimates. But unfortunately many others equally or more divergent could have been chosen.

Possibly the wide difference in estimates of proved reserves lie in differences among estimators of what may be called "proved."

When reserve estimates are carefully made by competent men, they may stand the test of time. And the method followed in each case should be the one best suited to the information available.

BOOKS

PROCESS CONTROL. By A. J. Young. Published by Instruments Publishing Co., 845 Ridge Avenue, Pittsburgh 12. 132 pp.

Instrument and plant engineers who want a better understanding of the fundamentals of process-control equipment will find it in this text. Clearly explained and free of advanced mathematics, the book offers a working knowledge of a wide variety of commercially available controllers—electronic, pneumatic, electrical, electropneumatic, and mechanical. It explains such essentials as the control problem, the operation of closed-loop control systems, modes of control, and control actions. Amply illustrated with process flow charts and control diagrams, it will prove especially helpful to engineers assigned to install new control equipment or to increase the efficiency of existing installations.

THE MIDDLE EAST, Revised edition 1954. Prepared by the Information Department of The Royal Institute of International Affairs, Chatham House, London. Published by the R.I.I.A., U.S. offices at 345 East Forty-sixth Street, New York 17. 590 pp., $6.50.

This is the 1954 edition of the text originally published in 1950 as a political and economic survey of the Middle East—both as a whole and country by country. It is unique both for its thoroughness of coverage in a single volume and for the welcome reception it received both in the Western nations and in the Middle East itself.

Accurate, comprehensive, and fair, this edition presents a balanced study of historical and recent developments in Middle East politics and economics. It was designed to serve the specialist as a compact reference work, and the general reader as a description of the region, its peoples, and its problems. It opens with an 80-page survey of the Middle East as a whole, then analyzes individually the countries of Arabia, Cyprus, Egypt, Iraq, Iran, Israel, Jordan, the Sudan, Syria and Lebanon, and Turkey.

For American oil men with a vital stake in Middle East affairs, this text offers a short cut to understanding of this oil-rich area.

NATURAL GAS ENGINEERING. By Maynard M. Stephens and Oscar F. Spencer. Published by Pennsylvania State University, Mineral Industries Extension Services, State College, Pa. 576 pp.

This third edition of a text originally written in 1939 has been thoroughly updated to include newest techniques and calculations used in natural-gas engineering. Its 12 chapters cover every phase of the subject from natural-gas industry development to regulation of gas flow. Designed for employe study groups or for individual self-study, it is written simply and illustrated fully. Each chapter has review questions and practice problems.

TABLE OF SINE AND COSINE INTEGRALS FOR ARGUMENTS FROM 10 TO 100. Published by National Bureau of Standards. 186 pp., $2.25. (Order from Government Printing Office, Washington 25, D. C.)

This is a reissue of mathematical tables, 13. The sine and cosine integrals have long played an important part in the theory of numbers and the calculus of probabilities. Lately, they have assumed increasing value in such fields as antenna theory, electromagnetic theory, and nuclear physics.

This table contains Si(x) and Ci(x), x = 10 (.01)100, 10D. In addition there are auxiliary tables of multiples of $\pi/2$, $(\frac{1}{2}p)$ $(1-p)$, $p(1-p^2)/6$ and $q(1-q^2)/6$ where $p+q = 1$, to facilitate interpolation in the tables.

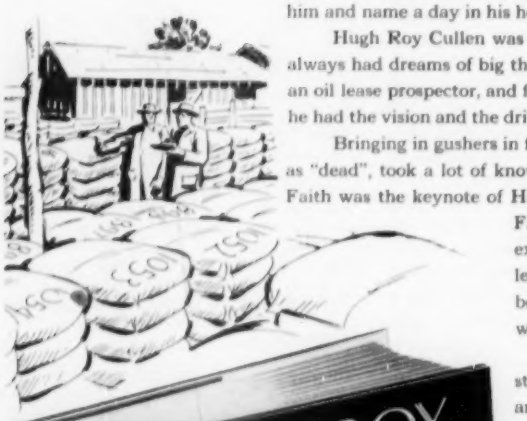
"The biggest heart in Texas"

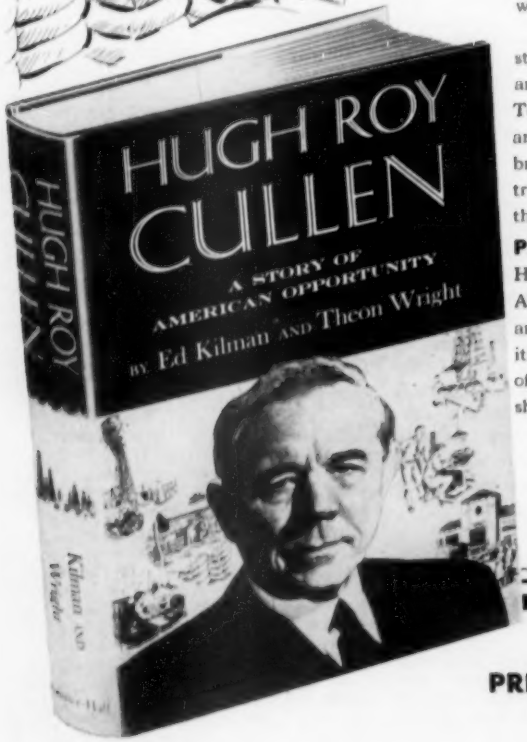
A newspaper reporter once characterized oil millionaire HUGH ROY CULLEN as "impulsive, opinionated, sharp-tongued and tactless as a Texas steer." To those who know him better, Cullen is lovable, gentle, deeply sentimental and sweet-tempered as a baby lamb. But no one in the length and breadth of Texas argues about one thing...Hugh Roy Cullen is enormously generous.

Known widely as Texas' "most unpredictable citizen," Cullen has given away more money in one day than most rich men make in a lifetime! He gives away opinions just as freely too — for which he incurs the applause of many, the wrath of some, but the respect of all. So respected is Cullen for his generosity that all of Houston turned out recently to praise him and name a day in his honor.

Hugh Roy Cullen was born in little Denton County, Texas—but he always had dreams of big things. As a struggling young cotton broker, as an oil lease prospector, and finally as an independent oil man on his own, he had the vision and the drive to make those dreams become real.

Bringing in gushers in fields that the big oil companies had given up as "dead", took a lot of know-how on Cullen's part . . . and a lot of *faith*. Faith was the keynote of Hugh Roy Cullen's entire life. Faith in himself. Faith in his fellow men. Faith in the ever-expanding opportunities America offered. Cullen grasped those opportunities . . . pioneered boldly and victoriously in a field where fortunes were made and lost overnight.





The story of Hugh Roy Cullen's life is the story of a fabulous and lovable character. It is an exciting story packed with sidelights on Texas and Texans, impetuous oil wildcatters and colorful politicians. It is a story of heartbreak and disappointment, of struggle and final triumph. It is an inspiring document of faith in the American ideal.

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by Louis J. Murphy

Charts for Simplifying Sucker-Rod Analyses—1

All charts referred to in this first installment of a new series are nomograms which will be presented in future issues.

DYNAMOMETER cards are big aids in modern analyses of well-pumping loads, but three factors requiring careful consideration during card study often present tedious mathematical chores. These are sucker-rod stretch, inertia effects on the sucker-rod string, and time-lag factors in the transmission of polished-rod motion.

In general, the most suitable equations require evaluation of one or more unwieldy constants. The three charts, which will be presented in later installments, are helpful in solving these problems. Their accuracy is sufficient for all usual dynamometer-card studies and design estimates. Where greater accuracy is required, the charts are excellent for checking calculations made by other methods.

Sucker-Rod Stretch

With long rods, as often met today, stretch during up-and-down strokes can appreciably alter the shape of the dynamometer card. There is, of course, an accompanying stretch in the tubing. Both rod and tubing stretch are easily computed with the first chart.

Example: The load change during operation at a pumping depth of 6,000 ft. is 5,000 lb. How much will the sucker rod stretch under these conditions if it has a 1-in. diameter and is made of steel?

Solution: Enter the chart at the left at the load change of 5,000 lb. and draw a straight line through the pumping depth of 6,000 ft. on the right. From the intersection of this line with the pivot stem, draw a straight line through the rod area of 0.785 sq. in. on the right. Read the rod stretch as 15 in. on the second stem from the left.

To use the chart to determine tubing stretch, enter with the cross-sectional area of the tubing, instead of the rod area. Tubing stretch will usually be much less than rod stretch because of the larger metal area in the tubing. In general, it seldom exceeds 20 per cent of the rod stretch. Total stretch is found by adding that of the rod and the tube.

Where load change during pumping is not known, it can be approximated by multiplying the difference between suction and discharge pressures by the area of the pump plunger.

This chart is based on the relation:

$$s = 12(dp)/re$$

where

s = rod stretch, in.
d = pumping depth, ft.
p = change in load, lb.
r = rod area, sq. in.
e = modulus of elasticity for steel = 30,000,000 psi.

Note that this chart may be used only for pumps fitted with steel sucker rods.

Sucker-Rod Inertia Effects

Because the sucker rod tends to retain its original state of rest or motion, the load on the driver is higher than normal at the start of the upstroke and lower than normal at the upper end of the stroke. In any analysis of pumping loads by means of dynamometer cards, the maximum acceleration of the sucker rod must be known if the maximum load on the rod system is to be computed. The second chart solves this problem easily and quickly.

Example: What is the maximum acceleration of a sucker-rod system having a stroke of 20 in. if the rod makes 30 s.p.m.?

Solution: Enter the chart at the left at the stroke length of 20 in. and draw a straight line through 30 s.p.m. on the right. At the intersection with the central stem, read the maximum acceleration as 8.4 ft. per second per second.

Once the maximum acceleration is known, the maximum load of the rod system can be computed using standard relations. Since the weight of the rod system must be known for this computation, specific data for the installation being studied must be available.

This chart is based on the relation:

$$A_m = lS^2/2{,}180$$

where

A_m = maximum acceleration of the sucker rod, feet per second per second
l = stroke length, in.
S = pumping speed, s.p.m.

Crank-Angle Lag

Time lag for transmission of the polished-rod motion is an important factor in deep wells because it represents a sizable portion of the pumping stroke. This time lag occurs during transmission of the motion of the crank to the plunger and from the plunger to the polished rod. To further complicate the problem, opening and closure of the pump valves changes the effect of time lag on system performance. The accompanying chart permits easy and rapid evaluation of crank-angle lag for typical modern rigs.

Example: What is the crank-angle lag in a pump making 20 s.p.m. when pumping at a depth of 4,000 ft.?

Solution: Enter the chart at the left at 20 s.p.m. and draw a straight line through the pumping depth of 4,000 ft. on the right. At the intersection with the central stem, read the crank-angle lag as 30°.

Note that a lag of 30° corresponds to more than 6 per cent of the pump stroke. At greater pumping depths the lag may be as high as 35 per cent of the stroke. Needless to say, a lag of this magnitude has an appreciable effect on pump performance.

This chart is based on the relation:

$$L = Sd/2{,}660$$

where

L = crank-angle lag, degrees
S = rod pumping speed, s.p.m.
d = pumping depth, ft.

Note: Where pumping speed is low, less than 10 s.p.m., when using the last two charts, solve as described above but move the decimal point in the actual speed one place to the right before entering the chart. Then move the decimal point one place to the left in the result to obtain the correct answer. Thus, with a pumping speed of 1 s.p.m., solve using a speed of 10 s.p.m. and move the decimal point one place to the left in the result.

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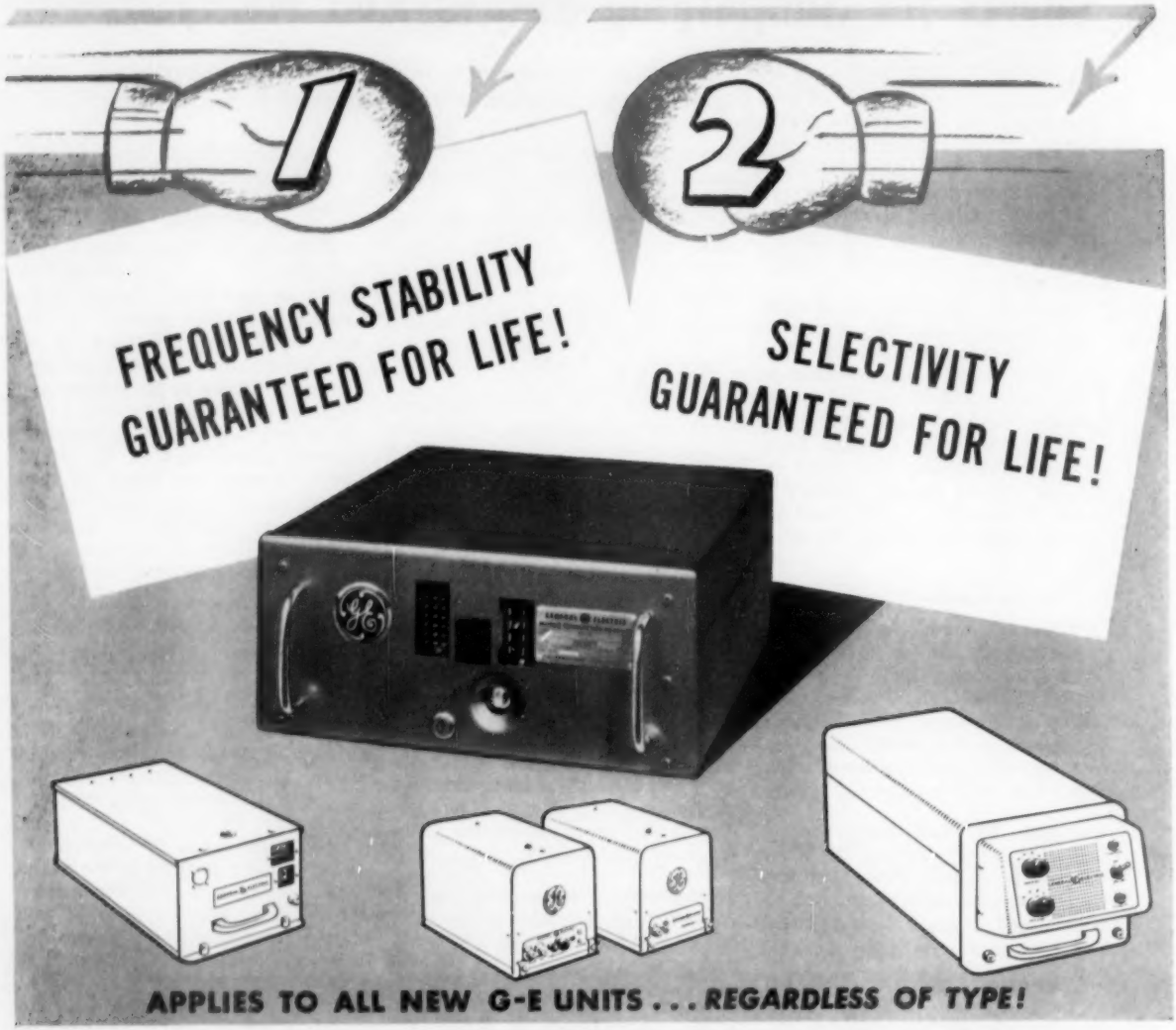
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by
Dr. R. F. Nielsen

UNSTEADY-STATE FLOW IN GAS RESERVOIRS—3

Solving a Radial Case of the Diffusivity Equation

IN a recent paper, Bruce, Peaceman, Rachford, and Rice[1] presented numerical solutions for the plane-radial case of the diffusivity equation for isothermal, linear flow with the outer boundary closed and constant efflux over the inner boundary. Usual assumptions for plane radial flow are made, and initial condition is of uniform pressure p_i. Reduced pressure P is the same as for the linear case, and is the pressure expressed as a fraction of original pressure p_i, or $P = p/p_i$. Reduced rate is defined for practical purposes as

$$Q = \frac{0.018\, q\, \mu\, T}{p_i^2\, K\, h} \qquad (1)$$

where

q = efflux in s.c.f. per day
μ = viscosity in cp.
T = reservoir temperature, °R.
p_i = initial pressure, psia.
K = permeability in perms (6.3 times permeability in darcies)
h = sand thickness, ft.

Reduced distance R for calculations is

$$R = \frac{1}{\log 200} \log \frac{200\, r}{r_e} \qquad (2)$$

where r is actual distance (any units) and r_e, radius of the outer (closed) boundary in the same units. This corresponds to a ratio of 200 between r_e and well radius r_w. Thus R = 1 when $r = r_e$, and R = 0 when $r = r_w = r_e/200$.

Fig. 1 shows reduced pressures and r_e and r_w, outer and inner boundary respectively, as a function of fractional depletion for various values of reduced efflux rate Q.[1] An approximate plot of P vs. R, from R = 0 to R = 1, may be sketched from the observation that dP/dR = 0 when R = 1, that P = 1 — F when R = 0.94, and that $dP/dR = 1.4\, Q/P_w$ when R = 0. For values of r_e/r_w greater than 200, it may be assumed (except for the initial transients) that steady state prevails from $r = r_e/200$ to r_w, unless flow is turbulent.

Assume a well of radius 0.3 ft. in a gas reservoir at a uniform pressure of 1,500 psia. is suddenly opened at 90 M.M.s.c.f. Radius of the outer boundary is 4,000 ft.; sand thickness, 50 ft.; permeability, 200 md. (1.26 perms); porosity, 0.18; temperature, 120° F. (580° R.); and gas viscosity 0.015 cp. Then, find how long before the transient boundary reaches 20, 60, and 4,000 ft., and determine bottom-hole pressure and the pressure at the outer boundary when the reservoir is 20 per cent depleted (F = 0.2). Reduced rate is

$$Q = \frac{0.018 \times 90 \times 10^6 \times 0.015 \times 580}{1{,}500 \times 1{,}500 \times 1.26 \times 50} = 0.1$$

Since the well radius is 0.3, r_e is momentarily taken as 60. From Equation 2, when r = 20, R = 0.8, and when r = 60, R = 1. The corresponding dot-dash lines cross the Q = 0.1 line at values of F equal to 0.0009 and 0.006. For calculating time, reservoir radius must be taken as 60 ft., and initial contents are therefore, 8.25 M.M.s.c.f.

Hence, when F = 0.0009, 7,400 s.c.f. have been produced and when F = 0.006, 50,000 s.c.f. At 90 M.M.s.c.f.d., time required is 0.000082 and 0.00055 days, or 7.1 and 47 seconds for the transient boundary to reach 20 and 60 ft., respectively. To estimate time for the transient to go 4,000 ft., r_w is taken as 4,000/200 or 20 ft., and it is assumed that soon after the transient has passed the 20-ft. radius, the production over this radius is nearly equal to that at the well. The original reservoir contents are 3.66×10^{10} s.c.f., substituting 4,000 for 60 in the previous calculation of V. When F = 0.006, 220 M.M.s.c.f. have been produced, so that the transient reaches the outer boundary 220/90 or 2.44 days after the well is opened.

When the reservoir is 20 per cent depleted (F = 0.2), reduced pressure at the outer boundary is about 0.81, just slightly over the weighted average of 0.8. Reduced pressure at the inner boundary, which must be taken as 20 ft., is 0.645. Actual pressures at these boundaries are, therefore, 1,215 and 967 psia., since p_i = 1,500. To find pressure at the well, assume pressure distribution is steady state from well to 20-ft. radius.

$$\frac{\pi \times 1.26 \times 50 \times (967^2 - p^2)}{14.7 \times 14.7 \times 0.015 \ln(20/0.3)} = 90 \times 10^6$$

Solving, p, bottom-hole pressure, is 563 psia.

Muskat's formula for rate of travel of the transient boundary on assumption of steady-state pressure distribution is:

$$t = \mu\, f\, r^2/4\, K\, p_i \qquad (3)$$

f being the porosity.

Taking r = 60 and the other values as above, this formula gives t = 0.0013 days. Time calculated above is 0.00055 days. While the conditions are not quite comparable, it is apparent that the transient boundary, in the case of gaseous flow, moves much faster than calculated on steady-state pressure distribution.

Reference

1. Bruce, Peaceman, Rachford, and Rice, Petroleum Trans. A.I.M.E., Vol. 198, p. 79 (1953).

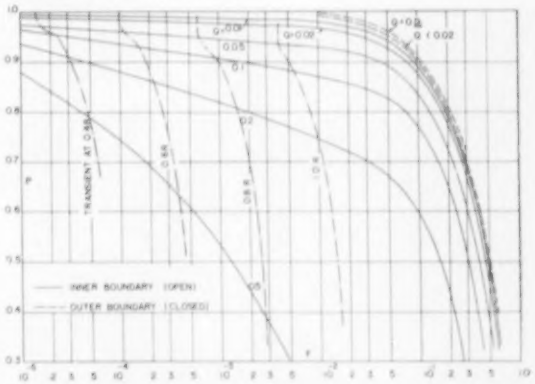
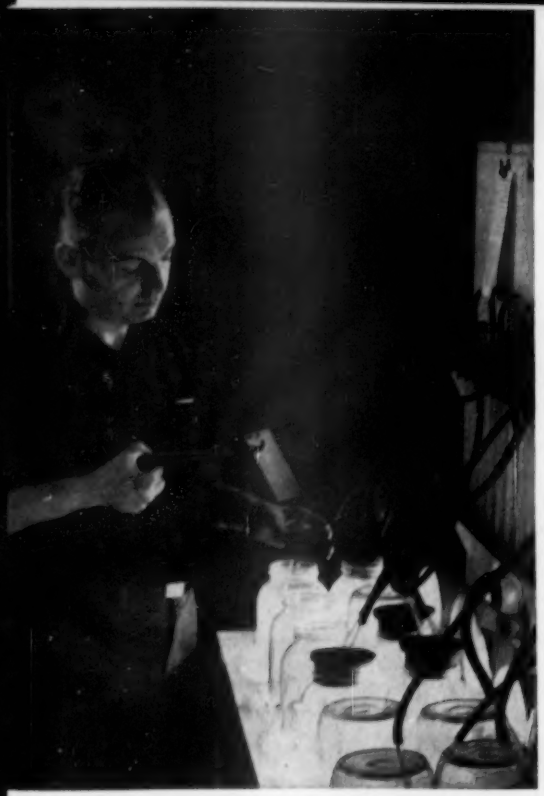


Fig. 1—Terminal reduced pressures P as a function of fractional depletion F for various values of reduced efflux rate Q in plane-radial flow of gases. After Bruce et al[1].

Author is associate professor of petroleum and natural-gas engineering, Pennsylvania State University.



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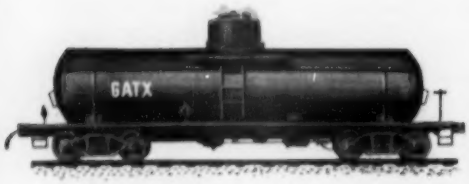

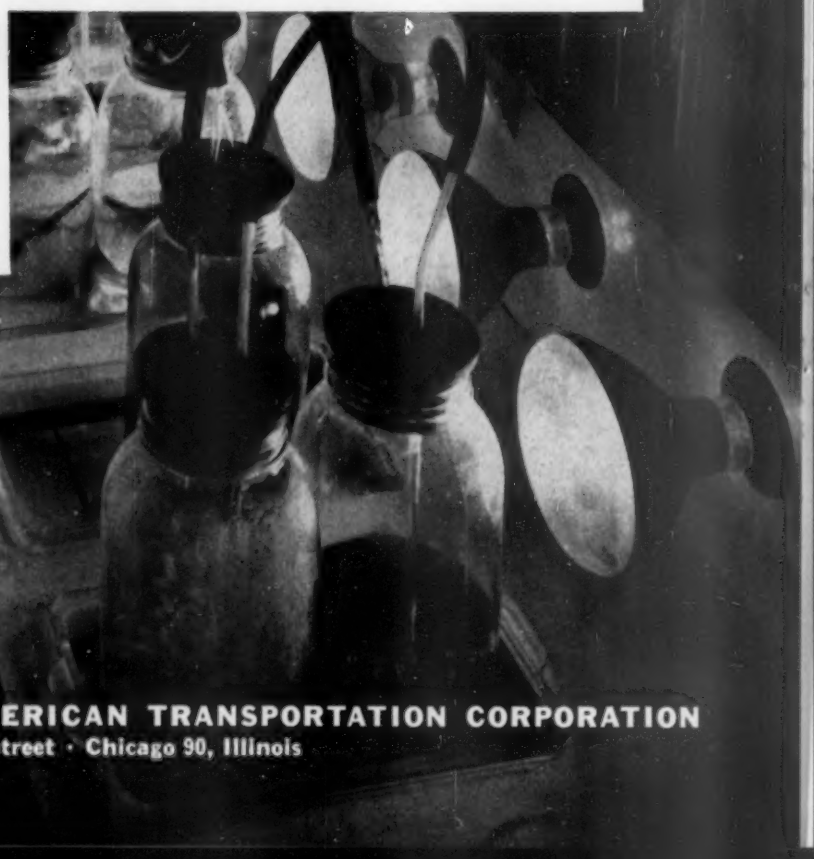

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ELECTRIC LOGGING—44

Interpreting Selective S. P. Curve No. 2

by R. I. Martin

IN this case the device is located opposite a thick permeable bed and the potential at G-G' is made equal to the static S.P. at this level. By a similar line of reasoning, it may be shown that Curve No. 2 will give zero readings in front of permeable beds and resistive formations. Deflections to the positive side will be observed in front of shales. The width of each peak is again equal to the bed thickness plus G-G'. The shape of the peak is triangular in front of thin beds and a plateau in front of thick beds.

Fig. 1 shows both curves No. 1 and No. 2, together with an ordinary S.P. log and a geologic section.

Two rules for interpretation may be stated:

1. If the applied potential U is kept equal to the static S.P. of the shales, the recorded curve stays on the zero line in front of shales and compact, highly resistive formation, but shows sharp peaks toward the negative side in front of permeable beds.

2. If the potential U is kept equal to the static S.P. of the permeable beds, the recorded curve stays on the zero line in front of permeable beds and also the highly resistive compact formation. But it shows sharp peaks toward the positive side in front of the shale beds.

The conditions would be reversed, however, in the less common case in which the static S.P. of the permeable beds is positive with respect to the shales.

It is found that static S.P.'s of the permeable beds are not always the same. For example, the water salinities may be different. Also, some permeable beds contain an appreciable amount of shaly material and show a pseudo static S.P. which is low. Less frequently, it may be found that different shales show different values of static S.P.

In practice, therefore, it is desirable that the impressed potentials be made equal to those of the most positive shales and those of the most negative permeable zones, respectively. If this is done, all permeable beds will give negative peaks on Curve No. 1, the greatest deflection being observed in front of beds where the S.P. is most negative.

In general, all the shale beds will give zero reading because the static S.P.'s of shales are practically equal. On Curve No. 2, all shales will give positive peaks. The permeable beds with greatest S.P. will correspond to zero readings, but the permeable beds with lesser static S.P. will give positive peaks which are, however, of lesser magnitude than those corresponding to the shales.

Fig. 2 illustrates these features, when the potentials have been chosen correctly. Peaks toward the negative side occur in beds 1, 2, 3, 4, and 8. The definition of beds 3 and 4 is made clear by the selective S.P. Curve No. 1. Only a slight feature on the resistivity curve given by the limestone device indicates that bed 4 exists.

In field practice the curves are not recorded separately as shown. The potential at G-G' is rapidly changed from one limit to the other. As a result, the space between curves No. 1 and No. 2 appears as a shaded area. The curves are then drawn as boundaries to this area.

Author is assistant professor of petroleum engineering, Missouri School of Mines and Metallurgy.

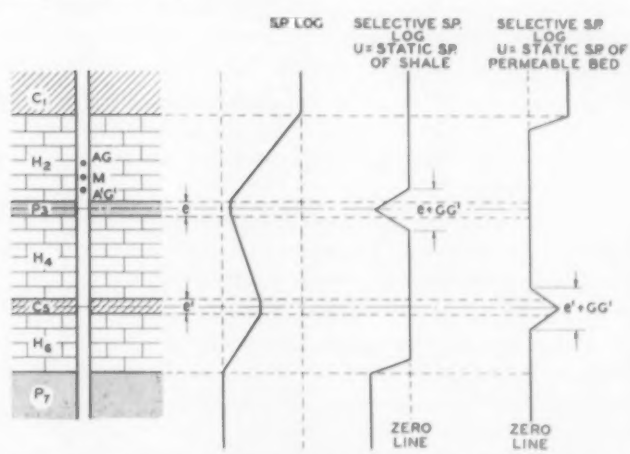

Fig. 1—A theoretical selective S.P. log, showing both Curves 1 and 2, with an ordinary S.P. log and a geologic section.

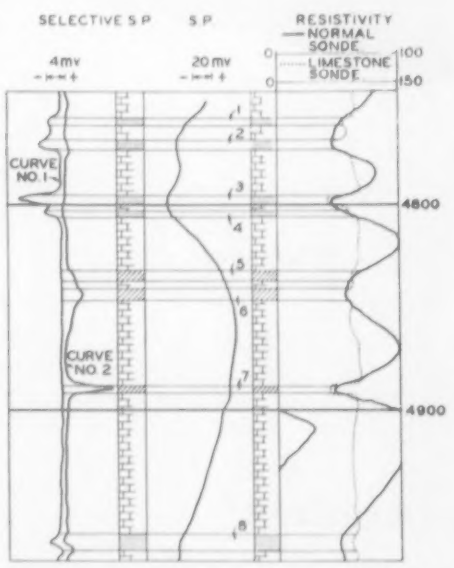

Fig. 2—A field case illustrating when potentials have been correctly chosen.

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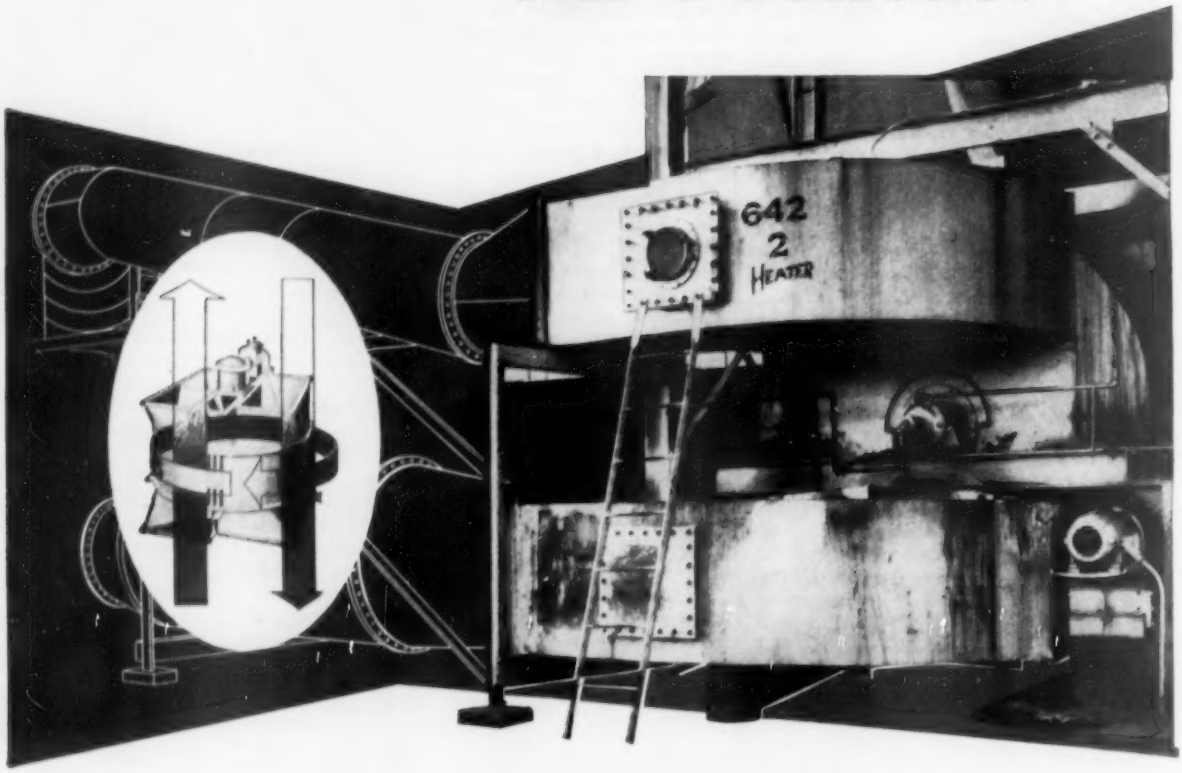

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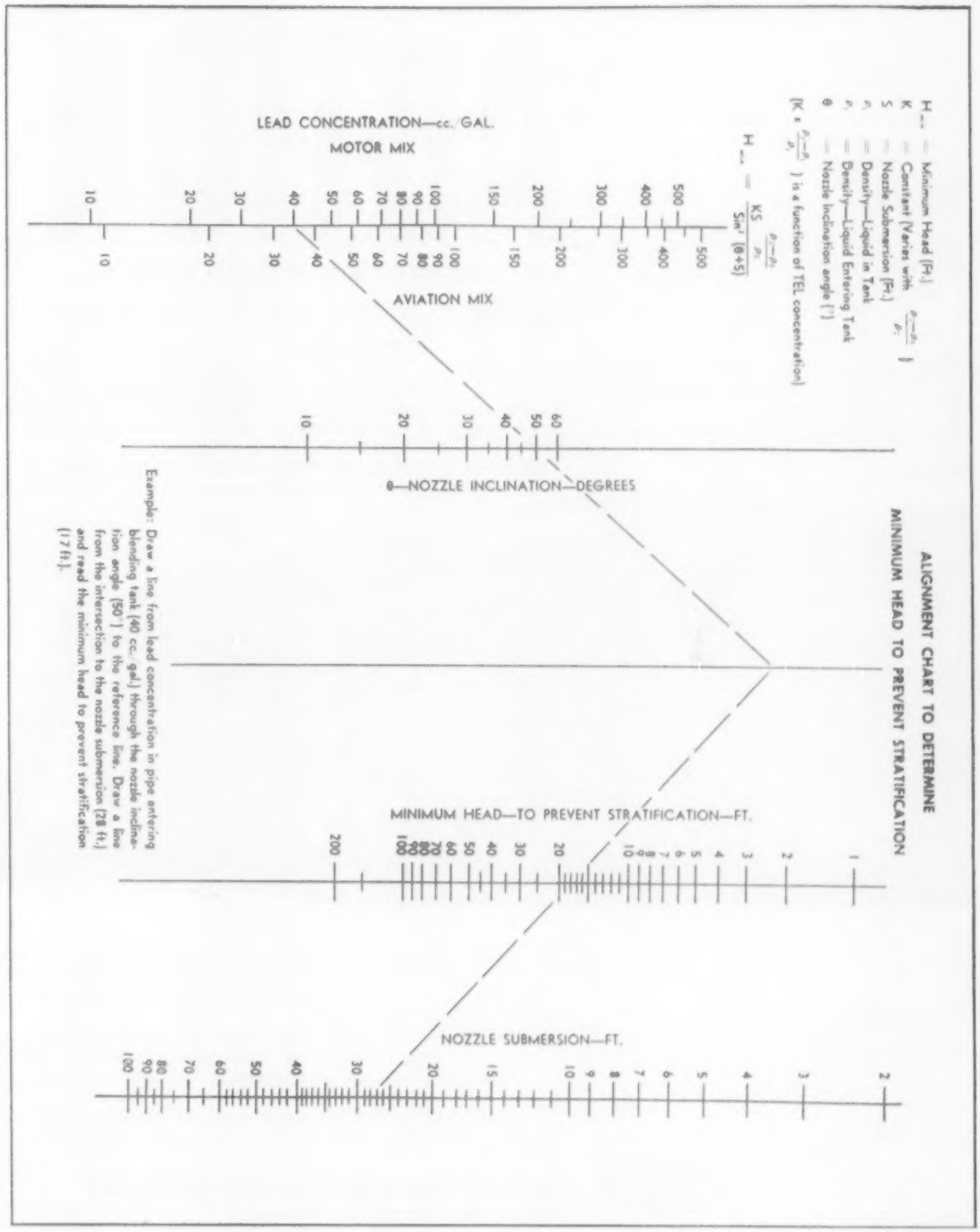
How to Design In-Tank Jet Mixing Systems—9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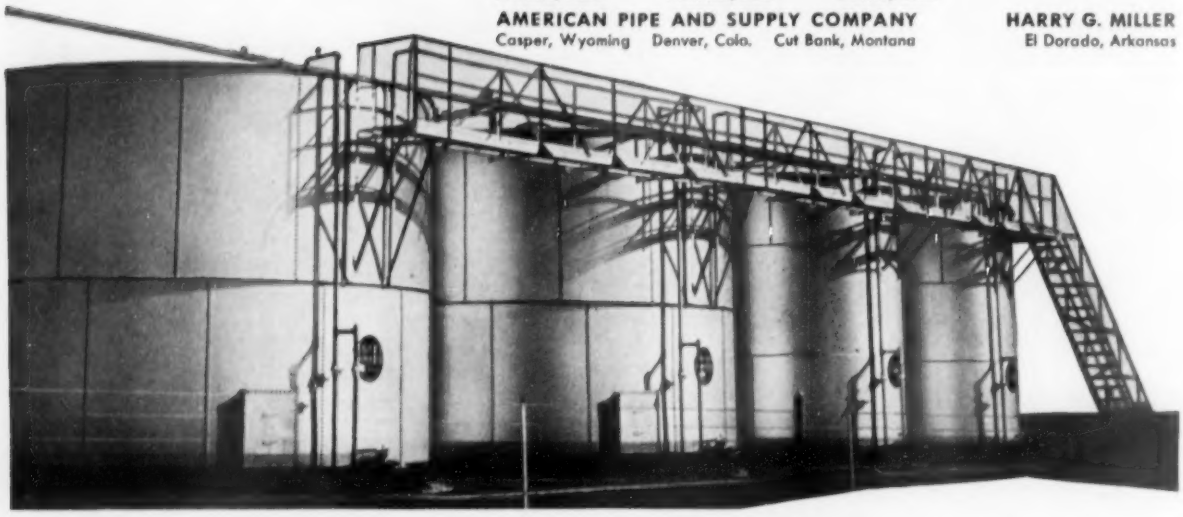

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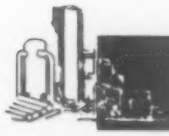

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In most instances, state or local regulations apply to shipments by tank truck, but where interstate traffic prevails, they are subject to the I.C.C. regulations. It is well to emphasize the importance of these regulations, since they are accepted as representing the highest degree of safety design and operation of equipment. As an aid to those desiring general information on rules and regulations as authorized by the I.C.C. for the transportation of these products, the Office of Chief Inspector of the Bureau of Explosives can supply this information.

Tank construction . . . The tank should be constructed in accordance with the rules of the A.S.M.E., or A.P.I.-A.S.M.E. code, with sufficient strength to withstand the pressure exerted by the product transported. For propane trucks, working pressure and pops should be set at 225 psi. and for commercial butane at 125 psi. These tanks should be equipped with loading and unloading valves, gaging devices, and proper relief valves that meet with the coded regulations.

Other equipment used in loading these products, such as pumps and loading hose, must be of sufficient strength to have a high bursting strength. In addition, the hose should be made of special rubber compounds to resist the unusual penetration and deteriorating action of these hydrocarbons. There are numerous types of pressure hose on the market that might be satisfactory from a standpoint of test pressure, but they must be constructed of a material which will be unaffected by the actions of these liquefied gases.

Author is with Warren Petroleum Corp. at Maysville, Okla. Paper presented at N.G.A.A. meeting, Oklahoma City, Sept. 17, 1954.

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Many tank trucks and cars must be loaded as the first step in making such distribution. The best and safest practices around any loading rack are summed up in this Field Processing series as:

1. Provide ample and safe tools.
2. Provide ample and safe lighting if night loading is being done.
3. Provide proper and ample fire equipment.
4. Take a periodic check of equipment and tools, be sure you are using safe hose and connections, and have a proper ground system.
5. Usually a clean place is a safe place. Do not allow greasy rags or other rubbish to accumulate. Keep a nice and tidy rack.
6. Provide ample help to tank-car loaders when snow or icy conditions exist.
7. Have operators on the loading rack who are properly trained, safety-minded, use extreme care, and are acting in conformity with all rules, regulations, and codes.
8. In selecting tools and equipment, it is important to realize that at no time does initial cost mean real economy nor assurance of safety in operations.

Faulty hose . . . The importance of proper attention to hose and hose couplings cannot be emphasized too strongly to the loaders. They should be checked and pressure-tested regularly. A large number of fires and accidents that are caused around the loading area, are attributable to the use of a faulty hose or coupling.

It is important that all loading hose be equipped with a bond wire connecting the metal couplings at each end. Where metal reinforcing is used throughout the length of the hose it serves the purpose; however, other types of wire may be molded into the hose itself.

Loading procedure . . . In the loading of L.P.G. and gasoline trucks it is of prime importance that as soon as a truck is received at the loading ramp, the loader shall see that all truck papers and tank capacity gages comply with state and I.C.C. regulations. Prior to the actual loading of the tanks, the static ground should be placed on an integral part of the tank, the wheels should be blocked, and at no time should any mechanical maintenance be performed on the truck while it is in a position to be loaded. This means that the oil should not be changed, or any adjustment made to the equipment of any nature. The reason for this is that sparks may be caused by a screw driver or a dipstick being dropped against the battery connectors.

It is imperative that the loaders make all connections to the truck. In this way, there will be no possibility of a mistake in lines and the wrong product being delivered into a tank which might not be of suitable pressure rating to accept the product.

After all hose connections and ground connections are made and it is ascertained that it will not leak, the loader may start his delivery to the receiving equipment.

Add odorant . . . It shall be the loader's responsibility to add odorant when required and to see that the volume delivered to the receiver does not exceed allowable capacity for the temperature of the product at the time of delivery.

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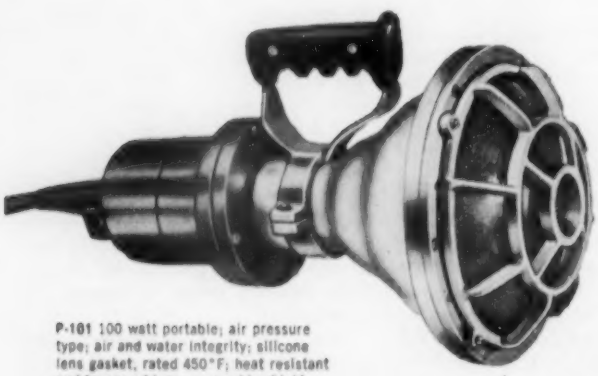

P-101 100 watt portable; air pressure type; air and water integrity; silicone lens gasket, rated 450°F; heat resistant and tempered lens; removable shield; 4000 hr. lamp; Wt. 8½ lbs; first static-free cable available for portable floodlights. APPROVED CLASS I, GROUPS A, B, C, D

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

What Are Average Costs of Refining?

Many refineries are said to be operating at a loss but nothing can be settled because of arguments over refining costs. Have average costs of refining been published? G. D. F. (June 1954).

It is not surprising that argument about refinery operating costs arises because there are literally dozens, if not hundreds, of different processing schemes used in refineries and because each refiner has developed his own line of products. And, to make the situation utterly confusing, the prices of products change from day to day while the price of crude oil remains constant. Accordingly, scarcely anything on the general or over-all cost of refining has been published.

However, the cost of refining including profit, can be ascertained with fair accuracy from over-all figures published by the Bureau of Census, the American Petroleum Institute, and the Interstate Commerce Commission, in the following general way:

1. Gross value of refined products
2. Less—cost of all crude oil at well
3. Less—cost of all transportation
4. Equals gross margin (operation and profit).

This general method (or elements of it) was explored in Table 1. Ralph Cassady, in his "Price Making and Price Behavior in the Petroleum Industry" (Yale University Press, New Haven, 1954), has made a similar study based on Mid-Continent operations and his results are shown in column 2 of Table 1. His refiner's margin (column 2) for cost of refining and transportation was corrected by estimated transportation costs (largely intrastate) of 13-21 cents per barrel (21 cents in 1919 and downward to 13 cents now), and then tabulated in column 4. The other costs (including profit) in column 4 are the "value added by manufacture" of the Bureau of the Census. Finally, the last two columns show the gross refiner's margin (cost plus profit or loss) for the various years but corrected to dollar values during 1946 and 1954 so that a number of values could be compared.

Apparently the average refiner's margin has remained substantially constant since 1923 except for inflation and deflation:

	1954 dollar value
Average 1919-1922, bbl.	$1.48
Average 1923-1929, bbl.	0.79
Average 1930-1939, bbl.	0.64
Average 1940-1951, bbl.	0.76
Average 1923-1951, bbl.	0.72

TABLE 1—ESTIMATE OF AVERAGE REFINERY OPERATING COST, DOLLARS PER BARREL—1919-1951

	(1) Average price of crude oil at well, $/bbl.	(2) Margin for refining cost and transportation (Cassady) $/bbl.	(3) Value added by manufacture (Bur. of Census) $/bbl.	(4) Approx. ref. cost and profit, $/bbl.	(5) Purchasing value of dollar	(6) Refining cost and profit, 1946 dollar value	(7) Refining cost and profit, 1954 dollar value
1919	2.10		1.06	1.06	0.81	1.19	1.68
1920	3.08	1.32		*1.10	.70	1.07	1.51
1921	1.72	.85	.83	.80	.78	.87	1.22
1922	1.61	1.15		*.93	.84	1.09	1.53
1923	1.24	.65	.63	.63	.82	.72	1.01
1924	1.43	.48		*.28	.82	.32	.45
1925	1.68	.64	.66	.66	.80	.73	1.04
1926	1.88	.56		*.36	.79	.40	.56
1927	1.30	.42	.47	.47	.81	.53	.74
1928	1.17	.63		*.45	.81	.51	.72
1929	1.27	.50	.61	.61	.82	.69	.98
1930	1.19	.35		*.19	.84	.22	.31
1931	.65	.35	.35	.35	.92	.45	.63
1932	.87	.37		*.21	1.02	.30	.42
1933	.67	.48	.37	.37	1.08	.56	.78
1934	1.00	.37		*.21	1.04	.30	.43
1935	.96	.55	.37	.37	1.02	.52	.74
1936	1.09	.59		*.44	1.01	.62	.87
1937	1.18	.52	.41	.41	.97	.55	.78
1938	1.13	.43		*.28	.99	.38	.54
1939	1.02	.50	.43	.43	1.01	.60	.85
1940	1.02	.47		*.33	1.00	.46	.65
1941	1.14	.61		*.47	.95	.62	.87
1942	1.19	.60		*.46	.86	.55	.78
1943	1.20	.59		*.45	.81	.51	.72
1944	1.21	.58		*.44	.80	.49	.69
1945	1.22	.60		*.46	.78	.50	.70
1946	1.41	.58		*.44	.72	.44	.62
1947	1.93	.84	.81	.81	.63	.71	1.00
1948	2.60	1.02		*.89	.58	.72	1.01
1949	2.54	.47		*.34	.59	.28	.39
1950	2.51	.75	.71	.71	.58	.57	.81
1951	2.53		.84	.84	.56	.65	.92
Average						0.58	0.81
Avg. since 1923						0.51	0.72

*Based on R. Cassady data, p. 137 of "Price Making and Price Behavior in the Petroleum Industry," Yale Univ. Press, New Haven, 1954.

Explanation of computations and references:

Column 1—From Statistical Abstract of the U. S. Cassady, Jr. (see Column 2) uses slightly different prices for 36° A.P.I. Mid-Continent crude oil.

Column 2—Ralph Cassady, "Price Making and Price Behavior in the Petroleum Industry," p. 137, Yale Univ. Press, New Haven, 1954. Based on Mid-Continent petroleum and operations.

Column 3—Bureau of the Census. Value of products shipped less cost of materials, divided by barrels processed in refineries.

Column 4—Value added by manufacture taken directly from Column 3, but 13-21 cents per barrel transportation and gathering cost subtracted from Cassady's Column 2. (21 cents in 1920 downward to 13 cents in 1951).

Column 5—Purchasing value of dollar (all items purchased) based on 1935-1939 =100. U. S. Dept. of Labor.

Columns 6 and 7—Operating costs for the various years corrected to dollar values of 1946 and of 1954.

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• Another 40′ joint of Transcontinental Gas Pipe Line Corporation's 36″ gas line is lowered in and welded. As welds were completed, joint sleeves were applied and doped. Pipe was never moved after welds were completed.

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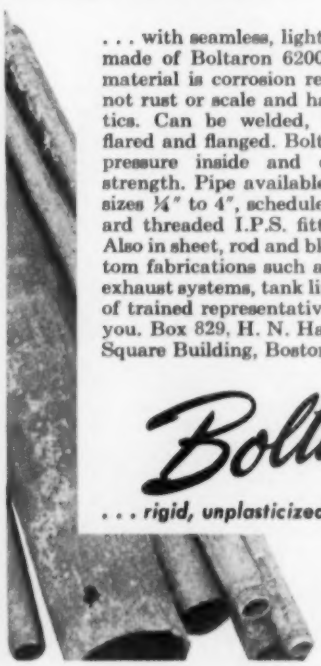

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NEWEST TECHNIQUE in pipeline tape-wrapping equipment in this power-driven machine shown here in use on a Georgia gas line.

Here's a performance report on . . .

Polyethylene pipeline wrapping

by Marshall E. Parker

FULL-SCALE field tests made recently on a 12-mile section of an 8-in. pipeline are very encouraging for the future use of polyethylene tape as a pipe wrap for corrosion mitigation.

The tape used is a pressure-sensitive type with an oriented polyethylene film of 8 mils and an adhesive mass of 4 mils. It has a very high volume resistivity, high dielectric strength, almost negligible moisture absorption, and excellent mechanical properties. For pipe-wrapping material it has the obvious advantage of being applicable without elaborate equipment. And it is an attractive material for field joints, yard piping, and other small applications.

For long-line service, however, the conservative engineer is wary of accepting a new material on the basis of small-scale or short-time tests. A full-scale test is needed to answer many questions concerning performance.

Such a test has now been made, and the preliminary results are extremely encouraging. A 12.12-mile section of the Seadrift Pipeline Corp.'s 65-mile, 8-in. gas line from Burnell to Seadrift, Tex., was wrapped with 8-in. polyethylene tape and an outer, unbonded wrap of tar-saturated asbestos pipeline felt. The section is in gumbo and caliche soil having an average resistivity of 1,800-ohm-cm. (maximum observed at pipe depth, 2,100; minimum, 1,550).

Author is consultant corrosion engineer, Houston.

The remainder of the line was coated with a conventional system, consisting of a coal-tar primer followed by a 3/32-in. coat of coal-tar enamel with a bonded outer wrap of glass-reinforced felt.

An 18-mile section immediately to the east of the tape-coated section was isolated by insulating joints, as was the taped section, to permit direct comparison of performances (see Fig. 1). Soil resistivity in the enamel-coated section also has a average resistivity of about 1,800 ohm-cm., with a maximum value of 2,150 and a minimum of 1,490.

Coating tests . . . Both sections under study were buried by February 17, 1954. By March 29, date of the first survey on the sections, some 5 in. of rain had fallen. Thus it would appear that sufficient moisture and sufficient time had accumulated to yield valid data on the coating conductance and the current requirements.

Both sections tested were so short and had such low conductance to remote earth that no attempt was made to determine the extremely low values of line current flowing; all current measurements were of total drainage, measured in the drainage circuit. Temporary ground beds were used with a six-volt battery as the current source.

Prior to application of test current, the pipe-to-soil potentials were observed so that polarization effects could be studied. Data taken during the test—potentials with current "off" and "on"—make possible the determination of total leakage conductance as well as current requirements for cathodic protection.

A cathodic protection system for the line is now being designed, and its future performance will yield further data on the coating systems.

The field data are summarized and calculations for leakage conductance are shown in Tables 1 and 2. The average driving voltage for the taped section is taken as the arithmetic mean since the attenuation is so slight.

Note that in first test conductance of the section wrapped with polyethylene was about one-third that of the enamel-coated section. The second test showed no change in the conductance of the taped section but a slight increase in that of the other.

It is not felt that the change in conductance of the enamel actually represents any deterioration of the coating; it is more probable that the tape

TABLE 1
Coating Conductance and Current Requirement tests—March 29, 1954

Location	Pipe-to-soil potential: Static	On	Off	Driving voltage	Polarization pot.
B	598	1,163	676	487	78
E	600	1,162	678	484	78
F	575	1,117	650	467	75
H	620	1,155	693	462	73
J	612	1,145	685	460	73
A	625	1,017	805	212	180
O	644	1,165	749	148	105
N	651	1,211	768	146	117

All potentials are given in millivolts.

Calculation of Coating Conductance

Polyethylene tape section:

Total current drained = 76 ma.
Average driving voltage = 472 mv.
Input resistance = 472/76 = 6.22 ohms = 889,000 ohm-sq. ft. = 1.13 micromhos per sq. ft.

Coal-tar section:

Total current drained = 110 ma.
Average driving voltage = 169 mv.
Input resistance = 169/110 = 1.54 ohms = 318,000 ohm-sq. ft. = 3.15 micromhos per sq. ft.

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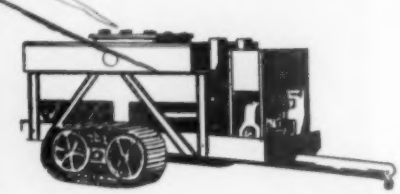

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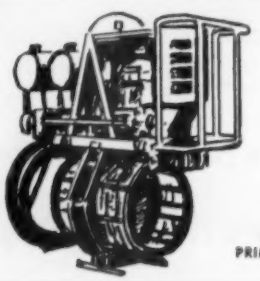

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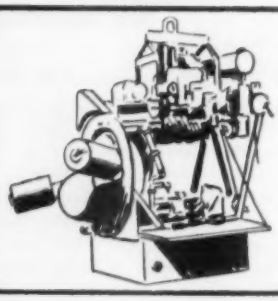

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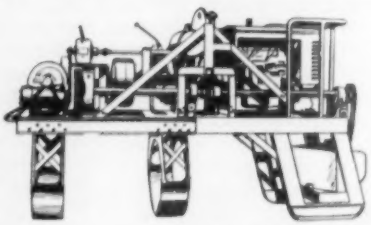

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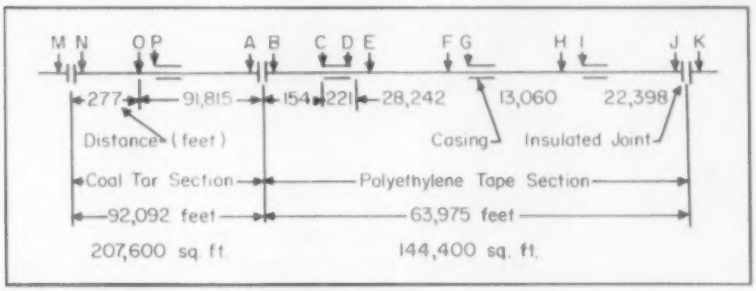


DIMENSIONS of test sections where tape was evaluated against coal tar.

simply reached a stable value in less time.

Possible advantages . . . The implications of such low conductance are twofold. First, current required for cathodic protection will be less, and will cost less. However, this is a relatively minor gain since the cost for cathodic protection of the enamel section is also small.

A second and less-obvious advantage is the almost complete freedom from possible interference effects with other structures. This results from the extremely low current densities involved, and the correlative advantage of a cathodic protection system which will be easily monitored and sensitive to any disturbance.

There is still another outstanding advantage in this low conductance. When the current demands are so very low, it seems short-sighted to supply only the trifling quantities needed without taking advantage of the situation to obtain more reliable protection. This can be had by installing what is essentially a constant-potential system instead of the conventional constant-current system. Then if any significant damage occurs to the coating, an increase in the current will automatically follow which will keep pipe-to-soil potential virtually constant.

This can be done by installing a low-resistance source so that the coating resistance will be the controlling factor in the circuit. In other words, installation of a low-potential, high-capacity source results in a self-regulating system.

TABLE 2
Coating Conductance and Current Requirement Tests—July 6, 1954

Location	Pipe-to-soil potential			Driving voltage	Polarization pot.
	Static	On	Off		
B	606	875	632	243	26
E	609	852	646	243	37
F	582	816	599	234	17
H	626	856	639	230	13
J	618	882	652	230	34
A	645	933	735	198	90
O	661	860	723	137	62
N	673	843	708	135	35

All potentials are given in millivolts.

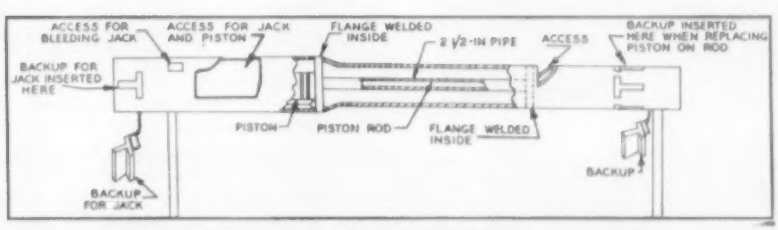
Calculation of Coating Conductance

Polyethylene tape section:

Total current drained = 38 ma.
Average driving voltage = 236 mv.
Input resistance = 236/38 = 6.22 ohms = 1.13 micromhos per sq. ft.

Coal-tar section:

Total current drained = 120 ma.
Average driving voltage = 157 mv.
Input resistance = 157/120 = 1.38 ohms = 3.52 micromhos per sq. ft.



"Gun-barrel" device removes pistons

A DEVICE resembling a gun barrel is being used effectively to remove compressor pistons from rods and then reassemble them at Cotton Valley Operator's Committee cycling plant, Cotton Valley, La.

The unit is specifically used to handle pistons from 600-hp. Clark Brothers compressors, but can be used with any type, dependent only on physical limitations.

The "gun-barrel effect" comes from

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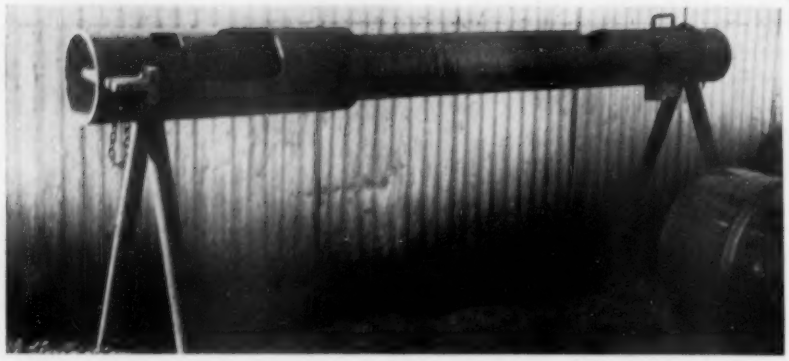

"GUN-BARREL" effect comes from the device's construction—two short lengths of different-diameter pipe welded together.

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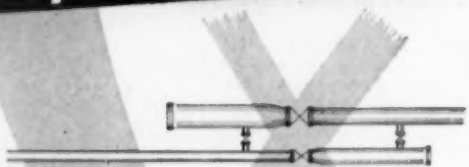

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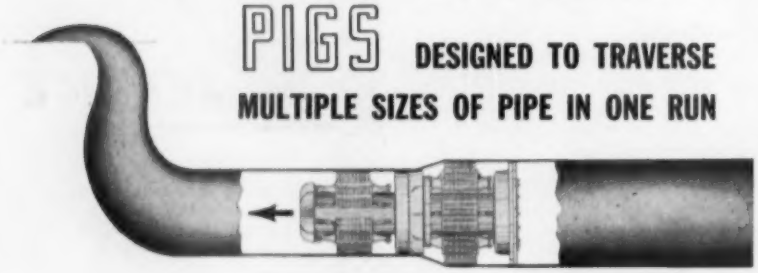

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Pipeline Patrol

the fact that the main component of the unit is made up of two short lengths of pipe welded together, with one having a larger diameter than the other. This horizontal member is supported by short lengths of pipe welded together in an inverted V at either end of the gun barrel.

The larger diameter section is of sufficient size to accommodate a hydraulic jack, which must lie sideways in the pipe. Two access holes are cut into this section, one a small one for inserting a tool which can be used for opening the bleed valve on the jack. The other opening is of considerable size so that the jack handle may be operated without interference.

A flange is welded inside the larger-diameter pipe just before it swages down to meet the smaller extension. Another flange is welded inside the small-diameter pipe about 4 ft. from the swaged section. A length of 2½-in. pipe connects the two flanges.

In using the gun barrel to remove a piston from the rod, the assembled rod and piston are inserted endways through the large-diameter pipe, with the rod extending through the 2½-in. pipe. An angle iron is used to support the piston at a convenient level. A hydraulic jack is then inserted behind the piston, and a T-shaped bar is placed crossways behind it. Slots cut into the pipe accommodate the T-shaped bar which acts as a backup for the jack.

Once the jack has been properly positioned, the handle is worked so as to extend the moving member of the jack. This then forces the rod out of the piston, restrained by the flange.

The procedure is somewhat different when reassembling the rod and piston. In this case, the piston is inserted in the small end of the gun barrel, and is backed up by a T-shaped bar inserted in slots near this end of the gun barrel. The rod is then inserted through the large end of the gun barrel into the 2½-in. pipe and placed so as to come up against the piston. An access hole has been cut in the small end of the pipe so the rod can be easily guided when starting it into the piston.

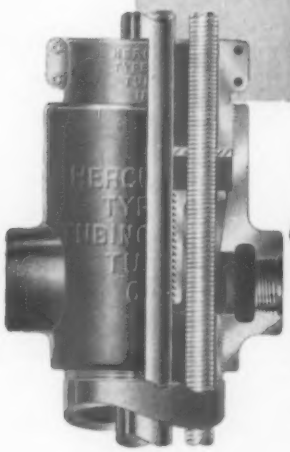
The jack is inserted behind the rod and the backup placed into the slot at the end of the large-diameter section of the pipe. Once again, the handle is worked so the moving member of the jack forces the rod horizontally through the gun barrel. However, this time it is forced into the piston and the reassembly job is completed.

The unit has served to cut down maintenance time to a considerable degree and has greatly simplified what had previously been a difficult task, said V. C. Keeling, plant foreman.

IN MEDIUM DEPTH WELLS

HERCULES "TYPE J-5-R" AND "RC" TUBING HEADS

DESIGNED FOR USE WITH REDA PUMPS



Designed for medium depth wells. Will suspend 5000 feet of 2" or 2½" Tubing or a proportionate amount of 3". Available in casing sizes from 5½" OD (which will suspend 2" or 2½" tubing only) to 7" OD which will suspend 2", 2½" or 3" tubing. Pressure cast steel body hydrostatically tested to over 4000 psi. 2" LP outlets furnished. (3" optional). Approximate over-all height, 14½".

Both heads feature the positive aligning hinged slips (which allow the electric cable to pass through the slips close to the tubing) and the overhead packing arrangement which packs off the tubing and electric cable simultaneously. The packing arrangement in both heads is tested to 2000 psi.

"TYPE J-5-R" TUBING HEAD

Built to support the weight of 10,000 feet of 2", 2½" or 3" Tubing, 5,000 feet of 4", or 4,500 feet of 5½" Casing. Available in casing sizes from 6⅝" to 9⅝" OD. 3" side outlets furnished. Pressure cast steel body tested to 4000 psi. Approximate over-all height, 23".

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"TYPE RC" TUBING HEAD

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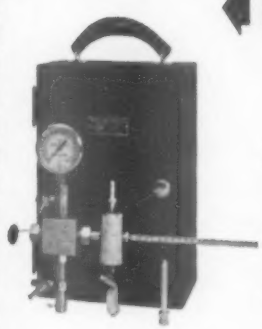
for testing gases under pressure.

Records dew point of gases under pressure.



- **PRECISION DETERMINATIONS:** Bureau of mines tests show that with manipulation dew points can be duplicated to within 0.2°F.
- **ACCURACY:** Averaging test measurements, the Bureau of Mines reported less than 0.2°F. Dew point temperature difference compared to known standards.
- **SAFETY:** Hydrostatic tests show a maximum working pressure of 3,000 psi. Adjustable mirror allows for safe visual observation into the pressure body.
- **SUITABILITY:** For use with gases under pressure; at pressures from atmospheric to 3,000 psi.
- **CONTINUOUS RECORD:** of dew point gas
- **RAPID RESPONSE:** To changing dew point of gas
- **RELIABLE RESULTS:** Obtained to allow for the control of dew point of natural gas in long distance high-pressure transmission lines.

This instrument records dew point of a continuous sample of natural gas at line pressure up to 1,500 psi.

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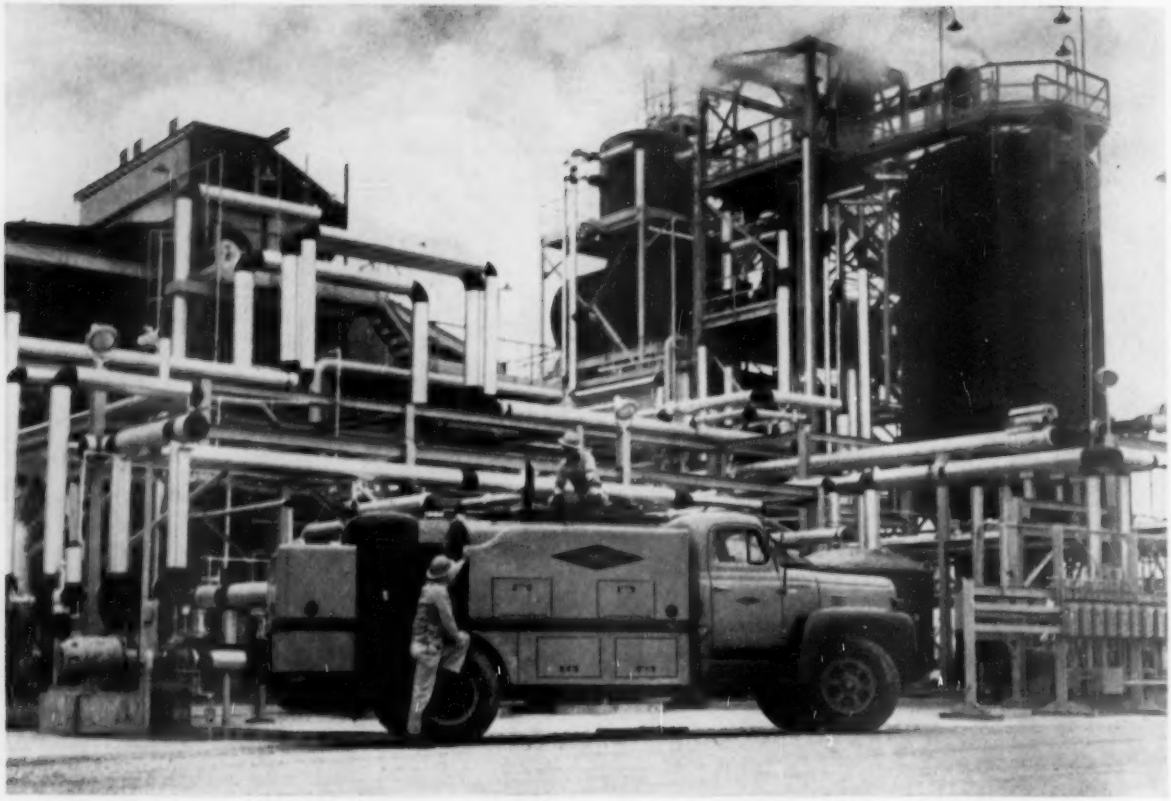
PLANT PROFITS UP $77,000 AFTER CHEMICAL CLEANING



DOWELL method of cleaning lines and process equipment cut plant turn-around time 22 days

Dowell was called to remove scale from pipe lines and process equipment in a plant where the semi-annual turn-around usually meant long, costly down-time. Dowell engineers used liquid solvents to do the job. It was not necessary to dismantle the equipment as the chemicals were introduced through regular connections. The job was done in far less time than ever before.

In fact, outage time for the year was reduced 22 days, representing an estimated $77,000 additional profit to the plant. As a result, Dowell Service was made a regular part of the plant's turn-around maintenance program.

The Dowell method of preventive maintenance cleaning with chemicals has helped to avoid the replacement of many miles of water and process lines and thousands of dollars worth of plant equipment. Chemical cleaning often uncovers weak points and helps to avoid later failures.

For complete details, call the nearest Dowell office. Or write DOWELL INCORPORATED, Tulsa 1, Okla., Dept. L-11.

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REFINING

Refinery Started

Excelsior's 2,000-bbl. unit will be Peace River's first

EDMONTON, Alta.—Preliminary work has started on a new 2,000-bbl. thermal cracking unit at Dawson Creek, B. C., by Excelsior Refineries.

Contract for the preliminary work is in the hands of Canadian Kellogg. Work has been completed on foundations and preparation of the site for a tank farm.

Koch Engineering, of Wichita, has the engineering and designing contract. Award of the general construction contract is expected in December.

The new refinery will be at the end of the Northern Alberta Railway from Edmonton. It will be the only refining unit in the Peace River district.

Oil for the refinery will come from the developing Sturgeon Lake field in northern Alberta.

At present there is no commercial oil production in the Peace River area, although noncommercial shows have been found.

Second Ultraformer Finished

CASPER, Wyo.—Standard Oil Co. (Ind.) has begun operation of the 3,750-bbl. per day Ultraforming unit at its Casper refinery. It is the second catalytic reforming unit of its type, the first having gone on stream last summer at Pan Am Southern Corp.'s El Dorado, Ark., refinery.

The largest Ultraformer, Pan American Refining Corp.'s 21,000-bbl. plant, will be completed in January, to be followed by two 9,000-bbl. per day units building at Indiana Standard's refineries at Wood River, Ill., and Sugar Creek, Mo.

A small Ultraformer of the same size as the one just completed at Casper is under consideration for the new Mandan, N. D., refinery, and tentatively planned is another unit to be built at the Salt Lake City refinery of Utah Oil Refining Co.

Waste Disposal Studied

NEW YORK.—Two research projects are now under way under the direction of the A.P.I. Division of Refining's Committee on Disposal of Refinery Wastes.

One, being handled by Kaiser Engineers is a compilation and organization of available information on dust-collecting items, beginning with cyclone separators.

A second project, just placed with Johns Hopkins University, deals with water quality criteria. It will comprise a literature search on toxicity data.

The committee is issuing its fifth volume of the Manual on Disposal of Refinery Waste which concerns the sampling and analysis of gases. Three chapters have been prepared as supplements to Volume II on Gases and Dusts. They deal with micrometeorology, air-pollution, surveys and flare design.

One new chapter is being added to Vol. III on chemical wastes, on the subject of biological treatment.

Future of Aromatics to Be Discussed at A.C.S. Meeting

CINCINNATI.—A subject of interest to many refiners—the future of aromatic hydrocarbons—will be discussed at a meeting of the Petroleum Division of the American Chemical Society here April 4 to 7.

The joint symposium with the Industrial and Engineering Division is headed by cochairmen A. L. Lyman, California Research Corp., and L. M. Roberts, Shell Chemical Co., both of San Francisco.

Two other symposia will be featured at the meeting. One, on spectroscopy in the petroleum industry, is headed by R. R. Brattain, of Shell Development Co., Emeryville, Calif. A joint session with the Division of Physical & Inorganic Chemistry will be devoted to molecular compounds of hydrocarbons and related substances. S. S. Shaffer, Humble Oil & Refining Co., Baytown, Tex., heads the committee on general sessions of the meeting.

A second Petroleum Division meeting, to be held in Minneapolis September 10-16, will concern the use of additives in petroleum fuels and another joint symposium on synthetic fuels and chemicals.

A.P.I. Midyear Program Set

NEW YORK.—A broad base of refining topics will receive attention at the American Petroleum Institute Division of Refining's midyear meeting to be held in St. Louis May 9-12. A total of about 50 papers are scheduled for delivery during 13 half-day sessions on 10 subjects.

Of particular interest will be two sessions on processing which will de-

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vote special attention to the use of byproduct hydrogen in the further refining and treating of petroleum fractions. Other sessions will deal with fuels and lubricants, maintenance, product control, pressure vessels and corrosion. The annual analytical research sessions will see presentation of 16 papers.

Although no definite decision has been reached it has been recommended that the 1956 midyear meeting be held in Montreal, Que. This would be the first time in history for the division to meet outside the United States.

Survey Shows Big Expansion In Chemical-Plant Building

WASHINGTON.—More than $1,216,000,000 in privately financed chemical-plant construction has been completed in the past 12 months, and the high rate of activity will continue, according to the Manufacturing Chemists' Association.

A survey of chemical-industry expansion shows that another $1,514,000,000 is represented in other plants under construction or definitely planned, the association said.

The survey covered more than 570 projects financed without government assistance. Of the total, 215 were completed between November 1, 1953, and October 31, 1954; another 219 are now being built at an estimated cost of $933,000,000; and another 138 projects involving $581,000,000 have been definitely committed.

The figures do not include projects announced as being "under consideration" or in the planning stage.

Despite some reported cutbacks in construction plans earlier this year, the association said, the survey appears "to bear out the prediction that the chemical industry will quadruple its production capacity by 1975."

Petrochemicals

Polyethylene Plant Opened

LONGVIEW, Tex.—Texas Eastman Co. has begun production of polyethylene plastic at a new plant here.

Texas Eastman said the plant opening represented the first new source of polyethylene molding and extrusion plastic in more than 10 years. Raw feed is propane, obtained from Humble Oil & Refining Co.

The new plant has a capacity of 20,000,000 lb. a year. Output will be marketed through Eastman Chemical Products, Inc., a sales subsidiary of Eastman Kodak Co.

See Composite and Refinery Catalogs, or Write for Specifications Folder

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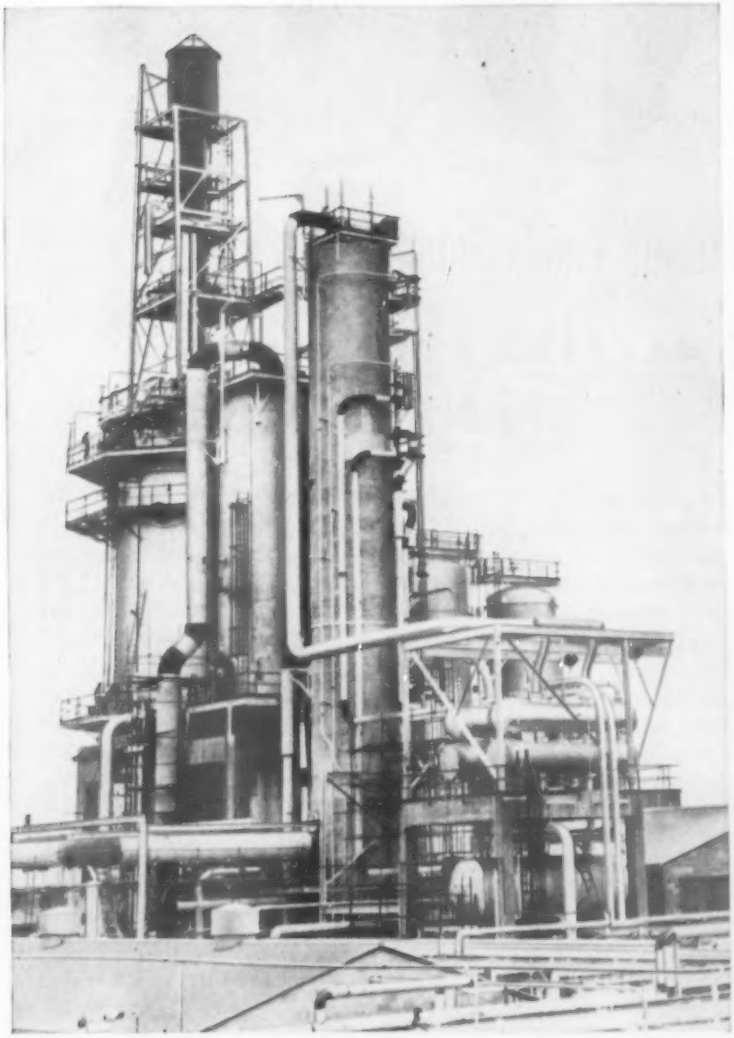
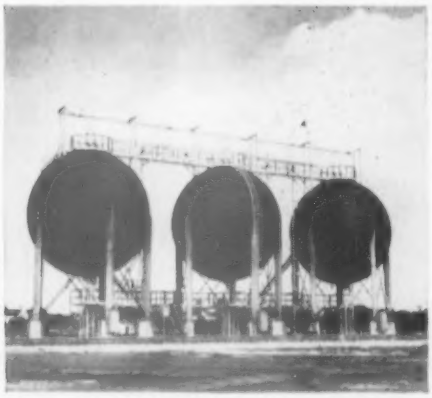
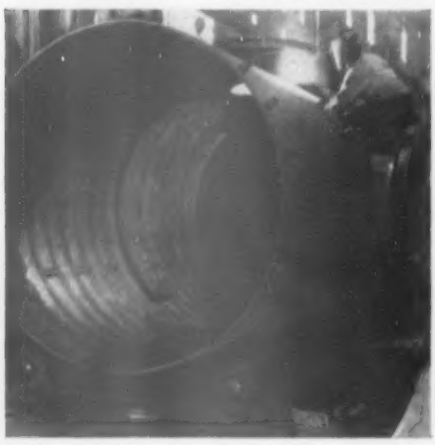


Continuing to serve America's refineries, GRAVER constructed the huge fractionator tower shown in the foreground for the new Mandan refinery of Standard Oil of Indiana. Reaching 120 ft. into the sky, it evidences the craftsmanship and experienced ability typical of Graver work.



GRAVERSPHERES are finding greater use than ever before with the tremendous growth of the refining and petrochemical industries. Ideally suited for high-pressure storage, they conform to Graver's exacting standards and are available in capacities ranging from 500 to 20,000 bbl.



Refiners depend on Graver for steel and alloy towers, pressure vessels and processing equipment. The large absorber tower shown above is Hastelloy-lined to protect against corrosion.

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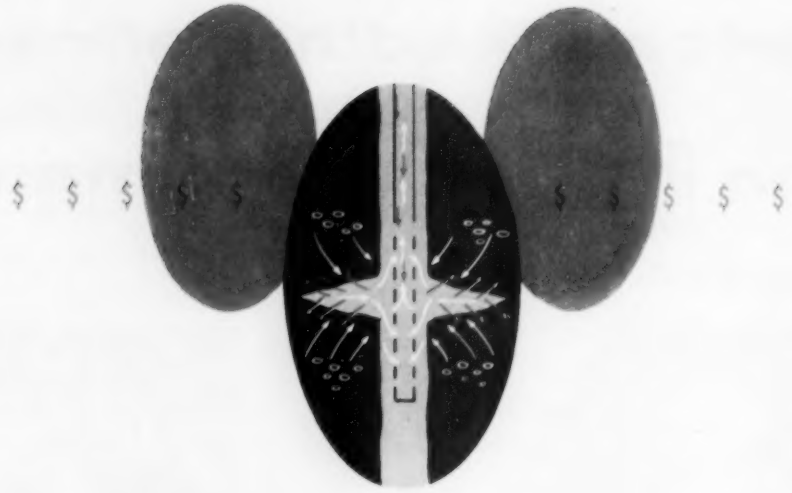

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Among the Drilling Contractors

Arrow Drilling Co., Dallas, has two new contract jobs under way in Mississippi, one an 8,000-ft. lower Tuscaloosa exploratory test in the Ovett area, Jones County, in the southeastern part of the state, and the other a 4,500-ft. Ordovician wildcat in Pontotoc County, in the Black Warrior basin, northeastern Mississipp. The latter test, 1 Naugher, 4 miles southeast of Pontotoc, is being drilled for L. E. Salmon. The other is for Ginther-Warren & Ginther, of Houston.

Petersen Drilling Co., Shreveport, is scheduled to drill a 6,800-ft. Wilcox test for Durbin Bond & Co. at a wildcat location 3½ miles southeast of Jeanette, in eastern Adams County, Mississippi. The test is listed as 1 Willard. It also has a new Wilcox test of its own under way in Jefferson County, to the north, at 1 Hawkins, 2 miles northwest of Sunnyside field.

Viersen & Cochran, Okmulgee, Okla., contracting and producing firm, will drill British-American Oil Producing Co.'s projected Wilcox test 1 Buster, in 26-24n-3w, northeast of North Barnes field, in northeastern Garfield County, western Oklahoma.

Anschutz Drilling Co., Wichita, Kans., has a new wildcat operation in southwestern Cheyenne County, Nebraska, where it is drilling for Sanford Production Co. at 1 Hadley. Location in 26-13n-53w is near the Kimball county line. It is 2 miles south of Southwest Potter field.

Schimmel Drilling Co., San Antonio, is drilling for Joe M. Sowarby and associates at 2 Parr, a wildcat test, in La Huerta Survey, 6½ miles north of Concepcion, in Duval County, Southwest Texas.

Walker-Wilson Drilling Co. is contracting for Glenn Dial and associates on a wildcat test, 1 Anderson, being drilled 8½ miles southeast of Big Beaver field, in Washington County, northeastern Colorado.

Potter Drilling Co. has a new contract job going at an outpost location southwest of South Badger Creek field, in Adams County, Colorado. The test is for Lubar Oil Co. at 1 Union Pacific, in 5-3s-57w.

Delta Gulf Drilling Co., Tyler, Tex., has taken on a contract for a deep test to be drilled for British-American Oil Producing Co. in the Hempshire area, in Jefferson Parish, coastal Louisiana.

Gibson & Hollinan, Dallas contracting firm, has taken on a well-deepening job in southeastern Grayson County,

L. M. Rhea (top, left), tool pusher, Wheeless Drilling Co., Shreveport; with A. E. Higginbotham (at his left), Mission Manufacturing Co. representative for the eastern Gulf Coast area; and day-tour crew on a rig the contractor has been operating for Woods Oil & Gas Co. in the Port Sulphur area of Plaquemines Parish, southeastern Louisiana. Crewmen are (top row, left to right): D. L. Barney, R. E. Archer, J. F. Breaux; and (bottom row, same order) A. H. Owen (driller), Milton Dominique, and S. J. Griffin. (Photograph by courtesy of Mission Manufacturing Co., Houston.)

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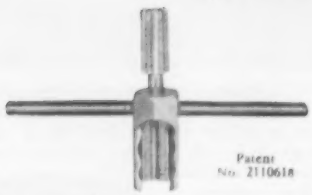

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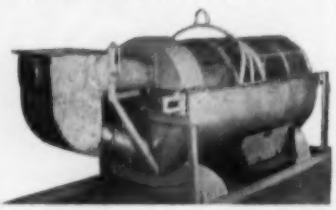

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North Texas. Contract with Star Oil Co., Dallas, calls for deepening a hole, abandoned last year at 7,814 ft. in the middle Pennsylvanian, to approximately 13,000 ft. to test the Ordovician. The test is Star's 1 Whisenant. Location is in the W. S. Thompson Survey, 3 miles northeast of Van Alstyne.

Eakle & Holder Drilling Co., Evansville, Ind., has moved a rotary rig from the Illinois basin area to Brandywine, Md., where it will drill a series of gas-storage wells on a contract with Washington Gas Light Co., Washington, D. C. The contractor's tool pusher on the rig is W. H. Denning, Henderson, Ky.

Gene Reid Drilling, Inc., Bakersfield, Calif., is drilling for Trico Oil & Gas Co. at a wildcat location 1½ miles south of Trico gas field, in northwestern Kern County, California. Location is for 1 Packwood, in 15-25-23.

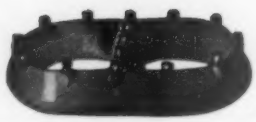
Brewster-Bartle Drilling Co., Houston, is under contract for a 12,000-ft. test to be drilled for Gulf Refining Co. a mile northwest of the latter's Grand Bay field, in the Mississippi River Delta area of Plaquemines Parish, Louisiana Gulf Coast.

Falcon Seaboard Drilling Co., Tulsa and Houston, is listed as the contractor on Tide Water Associated Oil Co.'s new outpost test to be drilled southeast of Church Point gas field, in Acadia Parish, southern Louisiana. The test, 1 Thibodeaux, in 83-8s-2e, is projected to 12,500 ft.

Montgomery Drilling Co., El Dorado, Ark., is scheduled to drill Carter Oil Co.'s first confirmation attempt in the recently discovered Bridge Brake field, 6 miles southeast of Monroe, in southeastern Ouachita Parish, northeastern Louisiana. The new test, 1 Rhymes-McGuire, is the north offset to the discovery well, completed last August in the Travis Peak at 5,500 ft. and the Pettit at 5,300 ft. It is projected to 6,400 ft.

Owens Drilling Co., Overton, Tex., has a rig on a wildcat location 3 miles east of Mount Enterprise, in Rusk County, East Texas, where it is putting down an 8,000-ft. test for J. P. Owens and associates at 1 Ross et al. Location, in the G. C. McKay Survey, is 6 miles west of Caledonia field, nearest production.

Stickle Drilling Co., Wichita, has a new wildcat operation under way for The Texas Co. in Harper County, Kansas. Location is 4½ miles south of Anthony at 1 Orr, in 23-34-7w.



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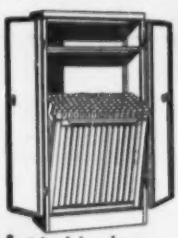

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The three Schlumberger resistivity curves are recorded simultaneously on one trip in the hole for a minimum of rig time. The sphere of influence of each curve, as depicted above, measures a distinct section of the formation. The curves are selected to give you a maximum of information.

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To geologists, engineers, oil executives and bankers alike, "A Schlumberger" is graphic unquestioned proof of production possibilities.

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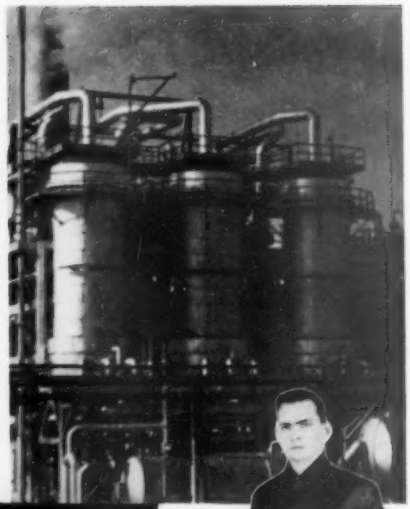

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The ultimate in protective footwear—famous for comfort, durability and the positive protection provided by the flanged steel safety toe box, tested to withstand 2,000 lbs. pressure. Grid-tread soles are long-wearing and guard against slipping on wet surfaces. Short, three-quarter and full-hip lengths.

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Maroon neoprene latex, duck lined, with black neoprene cleated soles and heels. Cushion insole for extra comfort. Short only, with or without "Toe-Saver."

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Rubber or neoprene. Durable, full-cut garments in a variety of styles tc meet every requirement or preference. Reinforced where extra strength is needed, without impairing comfort. Made with the care that assures extra value.

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GLOVES . . . "Goodall" Synplastic Gloves with superresistance to oils, rubber-solvent chemicals and acids. Extremely tough, light in weight, flexible. Carefully made and actually shaped to the hand, with curved fingers and thumbs.

HATS . . . "Hardboiled" Safety Hats, in fibreglass or aluminum. Other hats—rubber, neoprene or oiled—in variey of styles.

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The cards shown here are supplied for your convenience. Just ✓ ✓ ✓ check the circle with the number of the item in which you are interested, tear off the card, and drop it in the mail.

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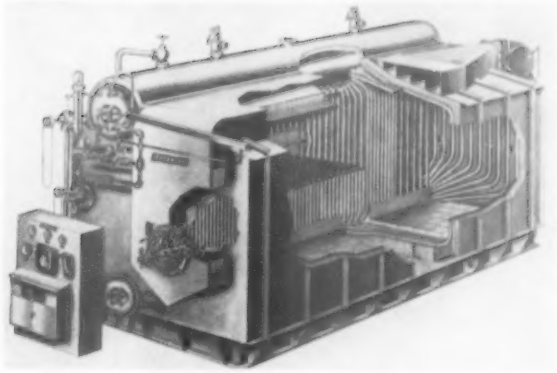
. . . What's New in Equipment?

Use the handy Time-Saver Cards ✓✓✓ to obtain additional information on these items

by Dan B. Miller



Packaged generator delivers 40,000 lb.

The Type D steam generator combines, in a completely packaged unit, the Type D tube arrangement and the most advanced features for production of low-cost steam. These steam generators are completely assembled and fire-tested at the factory before shipment. Designed for efficient, economical firing with gas, a variety of fuel oils, or both, the units are performance-rated for high availability and long life at capacities up to 40,000-lb. per hour continuous steaming; and may be combined in batteries for any required total capacity.

One of the outstanding design features is the rear-mounted, forced-draft fan providing an air-cooled furnace roof. By mounting the fan at the rear of the boiler, the firing front is left clear for easy access by operating personnel. Rear mounting of the fan removes noise from the area of the operator. The plenum chamber between fan and wind box provides for installation of steam-air preheater if desired.

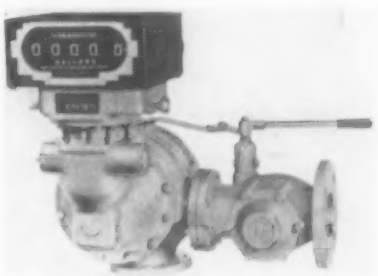
Other important features include tangent-tube water-wall construction, single or multiburners, optional soot blowers, adequate manhole and inspection openings, and a special air-shielded observation port. Actual testing may be witnessed by representatives of companies buying these boilers. *Superior Combustion Industries, Inc.*

Check No. 1 On The Time-Saver Card

●

New Valves Eliminate Shock Accompanying Rapid Cutoff

A new line of quantity control valves are engineered to eliminate the severe hydraulic shock accompanying rapid cutoff of large-volume flows. These new valves, available in 6, 4, 3, and 2-in. sizes, are designed to be used in conjunction with a Rockwell-developed multistage-register latching device on Rotocycle meters. These meters have rated capacities of 20 to 800 g.p.m. maximum for the 2 to 6-in. sizes inclusive.



Rapid closure with only relatively slight increases in pressure is an outstanding characteristic claimed for the valves. Closure time varies from 7½ seconds for the smaller to 12½ seconds for the larger sizes. In each case, closure is accomplished in three stages, each lasting a few seconds.

The valves are expected to have wide application in the refinery and marketing operations of the petroleum industry. The 6-in. size is especially adapted for the automatic filling of field storage tanks, sea-going tankers, barges, railroad tank cars and large transport trucks. The 3 and 4-in. valves are particularly suitable for use in loading tank trucks at bulk-plant terminals. *Meter and Valve Division, Rockwell Manufacturing Co.*

Check No. 2 On The Time-Saver Card

●

Swivel For Shallow To Medium Depth Is Improved

A new and improved swivel for the 3,000 to 5,000-ft. depth range, known as the Ideal N-35 Swivel, is similar in general design to the other N-series swivels, recently introduced. Features of the series include a low center of gravity to give greater stability in handling a body streamlined for maximum safety and the use of Uniflex wash-pipe packing-box assembly, to provide an improved method of packing off the mud. A Quick-Seal hose connection is standard equipment.

The N-35 has a comparative dead-load rating of 150 tons. It has an over-all height of 6 ft., 5¾ in., including the sub, and an over-all width of 25¾ in. *National Supply Co.*

Check No. 3 On The Time-Saver Card

What's New... Use the handy Time-Saver Cards

New Bonanza outperforms predecessor

Beechcraft Model C50 Twin-Bonanza is a new and more powerful version of the twin-engine Beechcraft Twin-Bonanza. This new craft has a cruising speed of 200 m.p.h. at only 66.6 per cent of power. Lycoming power plants are rated at a full 275 hp., an increase of 15 hp. over the model it supersedes.

Range of the new plane is listed at 1,100 miles. Top speed is 210 m.p.h. This increase in speed and range was achieved without sacrificing comfort or performance features. Other outstanding features include: new propeller design to provide simpler, more effective control; redesigned cabin heat controls to permit operation of the blower and automatic control system when the heating unit is in the off position; and redesigned radio panel, placing controls within easy reach of the pilot for quicker, easier use of all radio equipment. Optional features, which may be factory-installed, include: rotating navigation warning light for added safety in night flying; new propeller antiicer system for added safety in adverse weather conditions; and engine preheating system.

The new plane was engineered for safety, its low-wing design permitting 65 per cent of the weight of the plane to be located below and forward of the passengers. In addition to shoulder harnesses which come as standard equipment, the airplane is designed to an 8G flight-load safety factor, considerably higher than the 5.7G ultimate factor required by Civil Air Regulations. *Beech Aircraft Corp.*

Check No. 4 On The Time-Saver Card

●

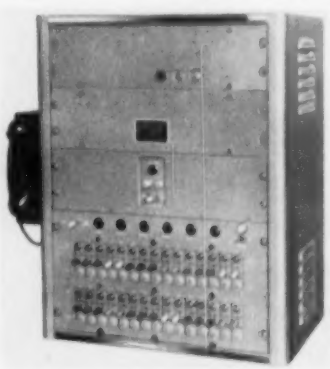
Digital Supervisory System Offers Flexible Control

An accurate digital supervisory control system has been designed for both remote measurement and for such control functions as remote shaft positioning, on-off switching, and proportional control.

The system, known as Electro-Span, may be used in conjunction with any electrical transmission medium, including telegraph circuits, telephone lines, VHF radio or microwave links. Voice communication can be time-shared where voice-channel band-width exists.

The Electro-Span remote tank-gaging system provides remote electrical measurement of liquid level. The system allows selection of a given tank, tank self-identification, and transmission of level information in ⅛-in. increments to 60 ft. The information, coded in digital form, is transmitted on a simple two-wire telegraph circuit from the remote-tank location to the central control station via the remote-tank selector.

Information is conveyed with great



accuracy and is virtually unaffected by such environmental vagaries as frequency drift, phase shift, voltage drop, and internal and external noise. By the use of the basic plug-in units and building blocks, many variations of Electro-Span tank gaging are available.

Remote control is available in the tone-signal control system which performs remote on-off control functions, alarm circuits, automatic preset fail-safe controls, system continuity test, and time-share telephone. All of these functions are performed over a single telephone pair or its equivalent.

Electro-Span tone-signal control is applicable for remote operation of unattended pipeline pumping stations or other similar installations. The system is operated as a frequency code system, and the various control functions are ordered as a simultaneous tone group. Automatic repeat-back confirmation of performance is also provided. The various units are plug-in design, allowing system flexibility in size and application. *Pacific Division, Bendix Aviation Corp.*

Check No. 5 On The Time-Saver Card

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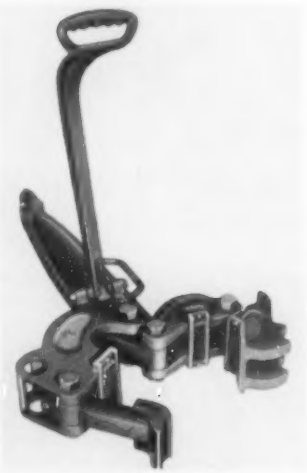

New Tongs Are Light And Ruggedly Made

Two new types of rotary tongs, Type F for blitz rigs, portable masts, water-well rigs, production workover rigs, and other light rotary work; and Type LF for portable shot hole, exploratory, geophysical, water-well rigs, production service, and extremely light tong requirements, are now being produced.

Especially designed for lightweight rotary rigs, Type F is a light but rugged three-jaw tong with jaws and lever of cast alloy steel treated for extra strength. Threaded-type hinge pins and slotted nuts are used to prevent the female hinge section from spreading and bending the pin. All hinge surfaces are machined for smoother operation and longer life.

Positive latching is assured by a T-type latch with convex surfaces which contacts the concave lugs in the jaw and prevents the tong from un-

The problem of getting a new plant on-stream... or an existing plant back on-stream after a shut-down ...often depends on fast, well-coordinated engineering, fabricating and delivery of process equipment. Lost time may run into thousands of dollars a day.

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That's why *personal expediting* is so important at SWECO. Getting your equipment delivered on time is a personal responsibility of one skilled SWECO engineer. He knows *your time* schedule. He follows... and leads ... and pushes *your job* through every stage: initial engineering... shop fabrication and testing... shipment and delivery. He coordinates the work of SWECO's large staff of skilled process and equipment engineers... *on your job*. He knows the progress *on your job*, from day to day, in SWECO's extensive fabricating shops. He answers to you for on-time delivery.

SWECO LEAN MEA COOLERS used in Monoethanolamine system for removal of carbon dioxide from crude hydrogen gas at the Brea Chemicals plant in Brea, Calif.

SWECO CONDENSERS at the Standard Oil Company of California plant in El Segundo, condense cat cracker vapors into gasoline, using water as coolant.

SWECO ABSORPTION PLANT TOWERS and SWECO heat exchangers were recently put into use at this Shell Oil Company absorption plant in Brea, California.

SWECO HEAT EXCHANGERS are used in crude oil distillation, thermofor catalytic cracking, catalytic reforming and polymerization at this General Petroleum Corp. refinery at Ferndale, Wash.

SWECO has more than 30 years experience in engineering and fabricating heat exchangers, pressure vessels, towers and other process equipment... of carbon steel and alloy metals... for big and not-so-big customers... in many process industries... in all parts of the world. Talk with any SWECO customer and he'll tell you: Design and workmanship, tops. Reliability, none better. But a standout quality of SWECO service is personal expediting and on-time delivery. On your next job, consult SWECO. Send for brochure giving details of SWECO products and services.

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THE BRAKE on an oil field and pipeline winch is important. That's why it's worth knowing that the brake of the Carco GO winch really works. In over three years of field use there has never been a single service complaint. The Carco GO winch brake is automatic. You can set the brake before winching in a load and it takes effect the moment clutch is released. There's no load drop or slip-back. The Carco GO brake gives smooth control over the load, longer lining life and will hold a total load even heavier than can be winched in to the tractor. Remember, the Carco GO winch was designed for oil field and pipeline work. It's a two-speed winch with large drum capacity and high line pull. Roller type fairlead is easily attached. See your nearest Carco dealer. PACIFIC CAR AND FOUNDRY COMPANY, Renton, Washington. Branches at Portland, Oregon, and Franklin Park, Illinois.

WINCHES
For All Industrial Tractors
CARCO

latching when tonging. The gooseneck hanger makes for perfect suspension, giving perfect balance. Six lug-jaw sizes provide a pipe-handling range from 2⅜ to 10¾ in. Approximate weight of Type F is 178 lb.

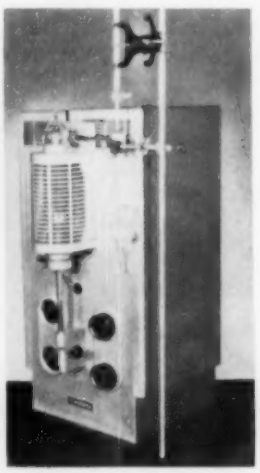
Type LF tong is almost identical in construction except that it is considerably smaller and weighs only 115 lb. Available with four lug-jaw sizes, Type LF tong may be used for pipe sizes from 2⅜ to 7 in. inclusive. *Byron Jackson Co.*

Check No. 6 On The Time-Saver Card

●

Combustion Unit Gives Rapid Sulfur Analysis

Fast combustion of heavy and light hydrocarbons is now possible with the Lindberg LI-500P H-F combustion unit. The induction furnace itself, prior to being modified for combustion of petroleum samples, was used extensively for sulfur and carbon determination in the ferrous industry.



All samples covered by A.S.T.M. bomb or lamp method can be completely combusted. Samples tested have shown good agreement with data accumulated by the bomb and lamp methods. Fifteen to twenty minutes are required for one complete analysis, from initial weighing to final computation. This will greatly increase the number of determinations per man per day, when related to methods currently in use.

Once the weighed sample is placed in the induction field, the operator devotes his entire attention to titrating. The titration assembly consists primarily of an absorption cell. In the titration itself, the combusted gases are passed through an acid solution of starch, potassium, iodide, and several drops of potassium iodate. At the end

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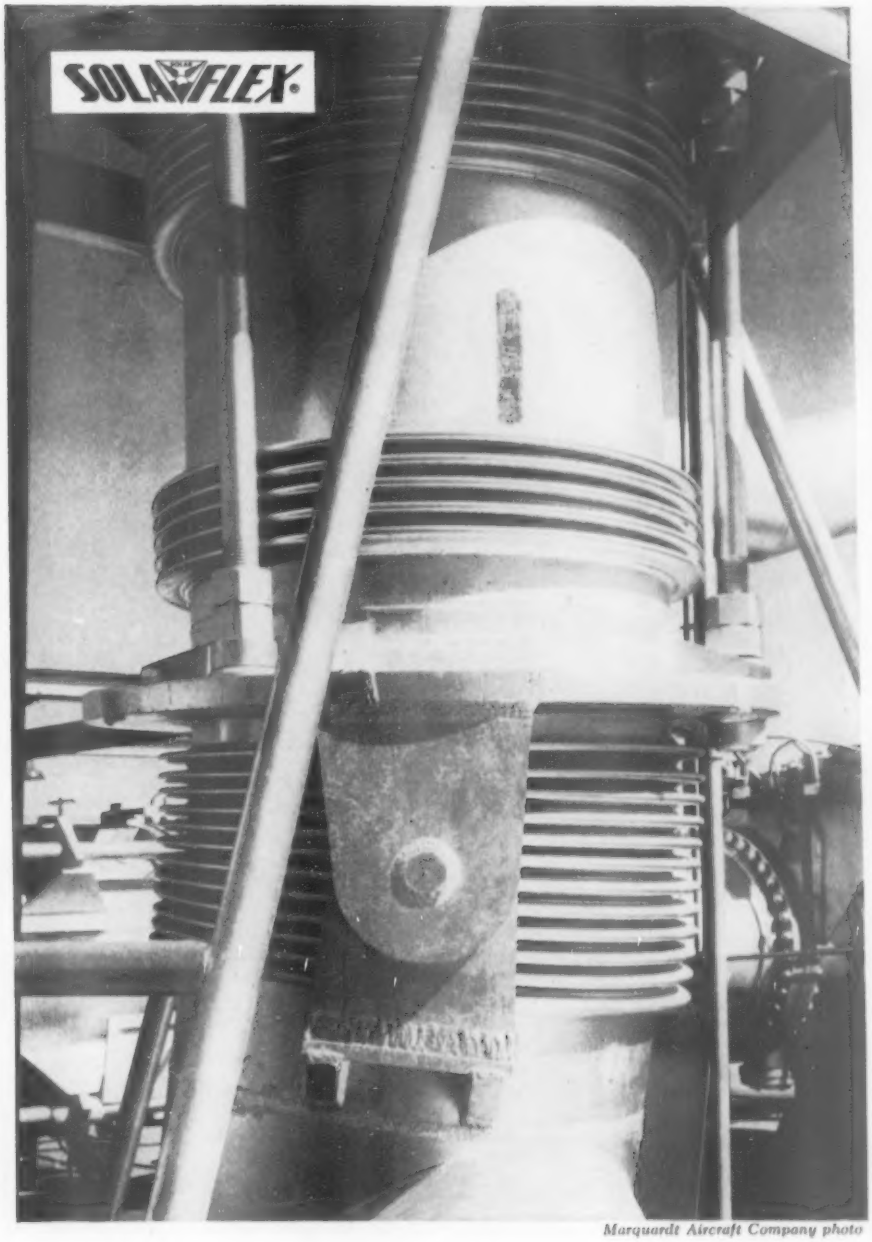

Marquardt Aircraft Company photo

A "hinge" for hot air

THE SOLA-FLEX BELLOWS shown above give flexibility to a 36 inch hot air line in a facility for engine testing. Operating at temperatures up to 650 F and pressures ranging to 150 psi, this Solar-built expansion joint allows both angular and lateral movement of the piping while conducting huge blasts of air.

This application of Sola-Flex bellows is unusual—yet typical of the varied design and production problems solved by Solar. Use of Sola-Flex expansion joints and convoluted couplings is growing rapidly in the oil, power, chemical, and aircraft industries.

Consult a Solar engineer, or send for Sola-Flex catalogs, if your piping problems call for a "hinge"!

SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

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Solar specializes in the manufacture of precision products from alloys and special metals for severe service. Solar's experience since 1927 is unduplicated in this field. Solar skills and facilities range from research, design and development through to mass production. Wherever heat, corrosion or difficult specifications are problems, Solar can help you solve them.

PLANTS. *In San Diego and Des Moines (photograph above). A total of 1,400,000 sq ft of floor space. Approximately 5,000 employees. Annual sales over $65,000,000.*

EQUIPMENT. *Production equipment for all types of metal fabrication—forming, machining, welding, brazing, casting, coating. Extensive laboratory and testing equipment. Facilities for development, prototype, limited or mass production.*

SERVICES. *Research, design, development, tooling and production engineering staffs. Experienced with all alloy steels, stainless alloys, super alloys, and titanium and its alloys. Government source inspection and Solar quality control meet rigid aircraft and commercial standards.*

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Current orders include aircraft engine and airframe parts, alloy castings, pneumatic ducting, atomic energy components. Customers include some of the most honored names among aircraft and industrial companies in the U.S. and Europe.

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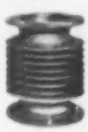

Bellows. *"Sola-Flex"® bellows and expansion joints in many designs from ½ in. up to the world's largest, 28 ft in diameter.*

Gas Turbines. *Solar "Mars" 50 hp engines for auxiliary generator sets, ground carts, portable fire pumps; Solar "Jupiter" 500 hp engines in variable and constant speed models.*

Ceramic Coatings. *"Solaramic"® is the Solar trade mark for a family of coatings that protects metals from heat, corrosion, galling and abrasion.*

Controls. *Complete control systems utilizing the new Solar "Microjet"® principle for control of gas turbines, jet engines and pneumatic devices.*

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of the burning period, the intensity of the blue color is adjusted to that at the start of the test. The amount of standard iodate solution added is a measure of the sulfur content of the sample. *Lindberg Engineering Co.*

Check No. 7 On The Time-Saver Card

●

Hydraulic Pump Jack Has No Gear Box Or Crank

This new B4CS hydraulic pumping jack has been in continuous operation 24 hours a day for the past 3 months. The unit is operating at 4,000 ft., pumping 50 bbl. per day and utilizing gas-engine power as the prime mover. This hydraulic beam pumper is rated at eight 4-ft. s.p.m. and 12,000-lb. polished-rod load.

The model B4CS contains no gear box or swinging cranks. A small hydraulic pump does the big job of circulating the hydraulic fluid to the power cylinder. Stroke speeds are selective from less than 1 up to 8 s.p.m. maximum. A ruggedly constructed hydraulic control valve provides the operator with finger-tip sensitivity of control.

A flexible bellows protects the piston rod against sand and dust, and the unit is automatically lubricated at all bearing points. *Pelton Water Wheel Co.*

Check No. 8 On The Time-Saver Card

●

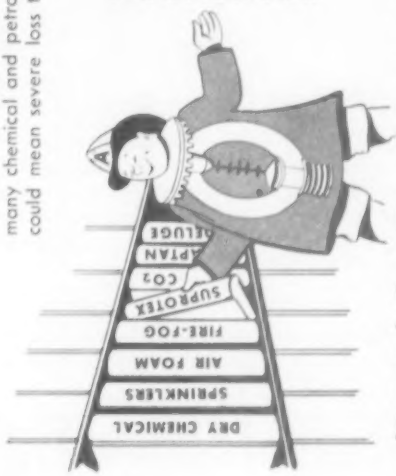
Tube Plugs Effectively Seal Leaky Condenser Tubes

The tube plug consists of two pieces: a brass bushing with collar, which is a close fit in the tube (its size must be specified as the tube inside diameter at the expanded section); and a steel plug, made with a slight taper to fit the inside taper of the bushing, which is then driven into the bushing. Note from the accompanying sketch that the outside of the bushing is parallel to

MAINTAINING PROFITS WITH ENGINEERED "Automatic" FIRE-FOG PROTECTION

Tank car loading and unloading operations are a major hazard to many chemical and petroleum processing plants. Even a localized fire could mean severe loss to business continuity, equipment and profits.

That's why "Automatic" Sprinkler engineers were called upon to design, manufacture and install fire protection as shown in operation at this large West Coast petro-chemical plant. ENGINEERED "Automatic" FIRE-FOG was the answer to this problem. Yours may call for fixed piping systems of "Automatic" Sprinklers, AIR FOAM, CO_2, or some other tried and proved method of fire control and extinguishment. The conditions involved dictate the procedure to follow in providing the proper type of protection "best by test" for any fire hazard.



"Automatic" Sprinkler staff of technically trained engineers as well as Laboratory and Test Yard facilities are available to you without cost. We'd welcome the opportunity to counsel with you as a friend—not just a supplier. There's a common objective in mind . . . safeguarding lives, property and profits from the constant menace of fire.

"Automatic" Sprinkler CORPORATION OF AMERICA YOUNGSTOWN, OHIO

Offices in Principal Cities of North and South America

Fight Corrosion

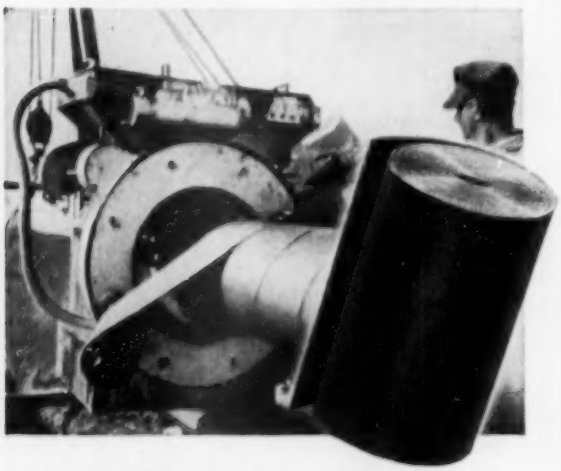
with these

Johns-Manville Pipe Protection Materials

...cut maintenance expense increase pipe life

TRANSHIELD Asbestos Felt—

This newly developed low cost pipe line protecting wrapper is designed for average soil conditions. It is reinforced with continuous glass yarns, parallel spaced on ¼" centers to give tear-free application strength. Made of coal-tar saturated asbestos, it acts as a continuous barrier to shield pipe line enamels from earth loads and soil stresses.



15-LB. ASBESTOS Pipe Line Felt—

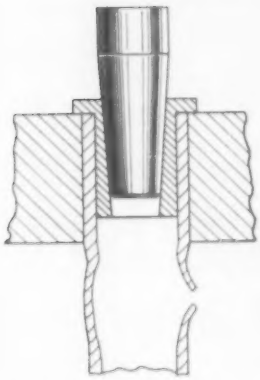
A heavy-duty material particularly suitable for severe soil conditions or where a heavier material than J-M Transhield is desired. Provides long life, toughness, flexibility, resistance to rot, decay, cracking, and impact. J-M 15-lb. Asbestos Felt now protects more than 100,000 miles of oil and gas pipe lines. Widths 2" to 36". Rolls any length desired.

TRANTEX® Polyvinyl Tape—

A widely used coating where ease of application is important . . . over field welded joints of mill-wrapped pipe . . . for rush coating needs. Pressure-sensitive . . . sticks to pipe on contact, forming a firm stable bond. Can be cold-applied by hand or with simple wrapping machines. In rocky soils, an outer wrap of J-M Transhield or J-M 15-lb. Asbestos Pipe Line Felt is recommended.

For further information about Johns-Manville Products for Pipe Line Protection, write to Johns-Manville, Box 60, New York 16, N. Y.; in Canada, 199 Bay St., Toronto 1, Ont.

Johns-Manville **PRODUCTS FOR PIPELINE PROTECTION**



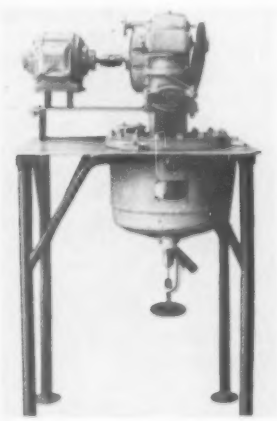
the tube and tube sheet. The expansion of the bushing or sleeve makes a tight fit. No damage can be done to the tube sheet. The device accomplishes parallel expansion and gives complete contact of the sleeve with the tube. *Elliot Co.*

Check No. 9 On The Time-Saver Card

●

Blender Packaged For On-Stream Operation

A two-component blender has been designed to provide industry with a complete equipment package for on-stream blending. The blender is suited for such applications as caustic dilution, asphalt blending, cutting of heavy-fuel oil, and blending of butane and gasoline.



This blender automatically delivers a uniform blend directly to tank trucks, tank cars, ships or storage. The desired blend may be duplicated with accurate uniformity for any number of batches and produced as needed in much less time and at lower cost than is possible by manual methods. Lower blending costs result from the elimination of added tank storage, mechanical mixing, and stratification. *Proportioneers, Inc.*

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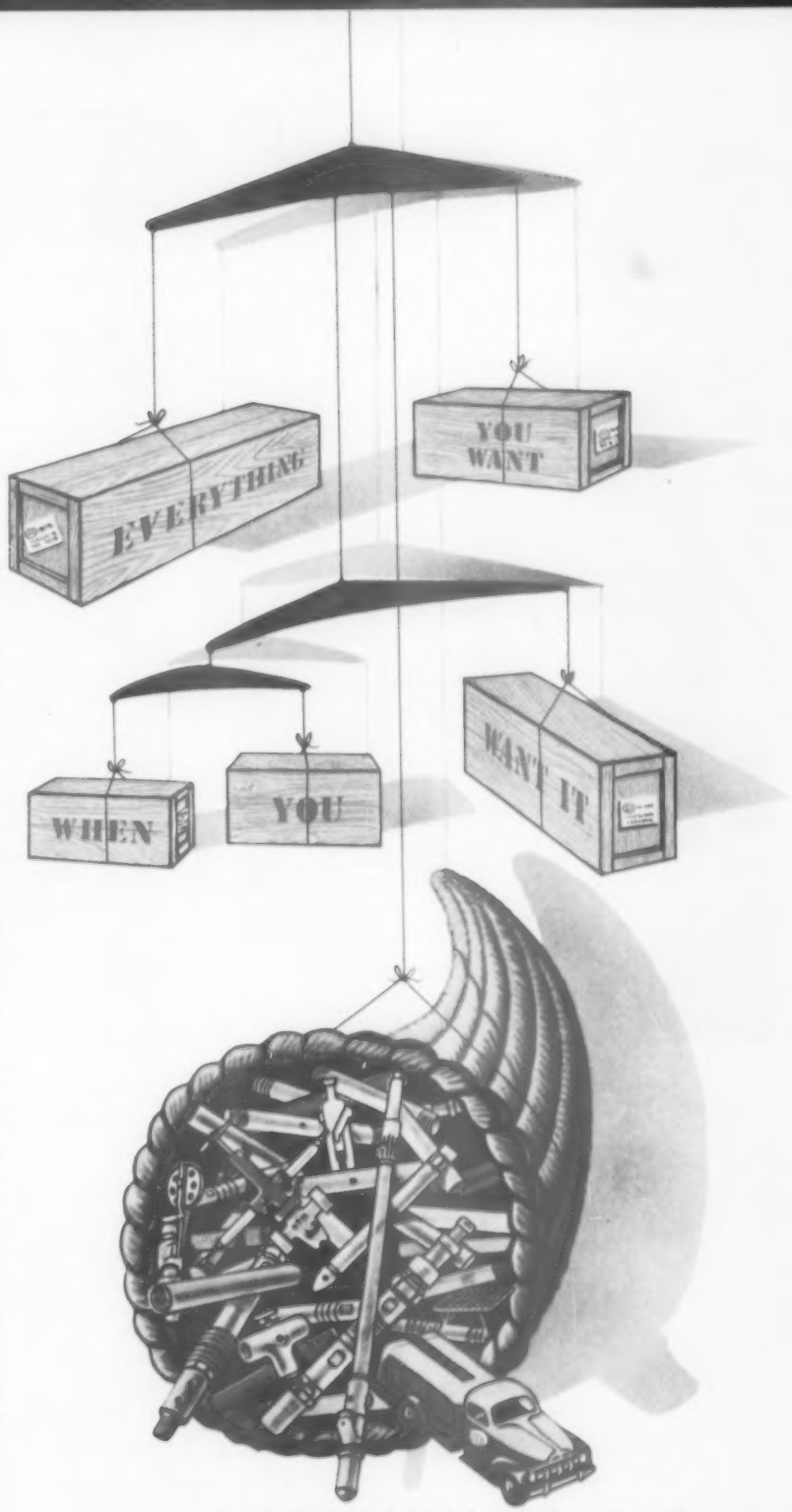


● **INVENTORY CONTROL** — efficient and dependable — is one of the most important single items we offer our customers. It's not for sale and you can't rent it. You can't use it on your lease and you won't find it in our catalog. And yet you'll get it on your next order to Otis. Keeping our field stocks complete and current is another way of giving our customers the best service we possibly can.

Balanced Combination for Best Service • Inventory Control
Research and Development • Experience • Field Supervision
Production Control • Expert Engineering • Coverage
Manufacturing • Testing and Inspection

OTIS

OTIS PRESSURE CONTROL, INC.

Branches Throughout the Oil Country

Roofing and Siding Contractor: Standard Asbestos Manufacturing & Insulating Company, Kansas City, Mo.

Here is the plant of the Natural Gas Storage Company of Illinois, Herscher, Ill. "Century" Asbestos-Cement Corrugated is used for the roofing and siding.

"Century" Corrugated is made of two permanent, highly fire-resistant materials —asbestos fiber and portland cement— compressed under tremendous hydraulic pressure to make strong, tough sheets for almost every roofing or siding requirement. It can't burn, rot or corrode. What's more, it resists weather, vermin and insects. There's rarely a need for maintenance and it never needs protective paint. "Century" Corrugated Asbestos is low in first cost and low in application cost . . . easily sawed, drilled and fitted on the job.

Be sure to write us for information about particular applications. We'll rush a reply with complete details.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

K&M Best in asbestos ®

They're NEW

- Bulletins
- Catalogs
- Brochures

for your copy, check ✓ ✓ the Time-Saver Cards.

The Hydraulic World Has Waited Years. This six-page foldout features the Intelli-Giant, a piece of equipment, used like a gun for ejecting a stream of water under high pressure, and capable of traversing and elevating. The unit was developed for hydraulic mining of mineral but is finding broad interest in refineries as a remote-control, fire-control device. The unit can be controlled manually or remotely. *Chiksan Co.*

Check No. 11 On The Time-Saver Card

●

Level Gages. Boiler water gages, level gages for the oil industry, and spare parts for level gages are illustrated in a 65-page section, perforated for catalog binding. Descriptions cover gage glasses, cocks, and valves, in addition to reflex, high-pressure reflex, and steam-heated gages. *Richard Klinger, Ltd.*

Check No. 12 On The Time-Saver Card

●

Aluminum Transport Tanks. A two-color, four-page sales bulletin presents facts and photographs about the recently announced line of aluminum petroleum transport tanks. Bulletin TT-54237 explains how the use of a new aluminum alloy has produced a tank of higher tensile strength than was previously possible in aluminum tanks. A welding technique developed for use with the new alloy produces welds with strength properties equal to that of the base metal. A large cutaway tank drawing shows the triple-dished heads and other construction details. Specifications complete the information given in the literature. *Heil Co.*

Check No. 13 On The Time-Saver Card

●

Macwhyte Safe-Lock Wire Rope Assemblies is the title of Catalog 5201. These assemblies have a wide variety of applications. They are a unit of flexible wire rope with permanently attached fittings of various types and sizes to make a complete operating flexible unit. These controls are used as a part of machinery and equipment or for slings

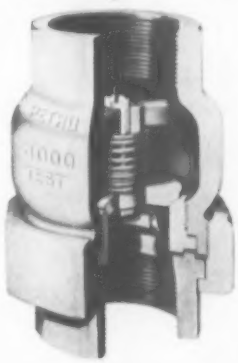
a *Quick* make and break union

Precision built of forged steel with cold working pressures from a vacuum to 3000 pounds and maximum temperature of 500 degrees F. (with special "O" Ring).
The ends and nut are octagon in shape. The ends are tapped to Briggs Standard steam threads.
HANDLE-BAR
Nut threads are rust-proof, spark-proof, and permanently lubricated with Udylite Cadmium.
A positive pressure seal is effected with a synthetic oil-resistant "O" Ring set in a groove between the two mating surfaces. Replaceable "O" Ring will not drop out when union is disconnected.

HANDLE-BAR "O" RING QUICK TYPE UNIONS

These unions are volume produced from forgings to finished union in our own plant to provide price and performance at its best. They do not depend upon compression or force as the terms relate to common gasket type unions. Hand tightening of nut will hold rated pressure. "O" Ring unions are recommended for mud, cementing, crude oil, lube oil, natural gas and water and vacuum services. Excellent for acidizing, fuel oil, kerosene and gasoline.

PETRO UNION CHECK VALVES



These valves work in any position, vertical, horizontal or upside down. The spring controls opening and closing of poppet valve in accordance with the volume and velocity of the flow. These valves are highly recommended for steam, water, hot or cold oil, gas, gasoline and process lines. Excellent as a discharge valve on reciprocating pumps. Petro, Hydro or Handle-Bar are Udylited and available with bronze or stainless steel seats.

WRITE DEPARTMENT O

For additional information about these Unions or refer to listings in the new Refinery or Composite Catalogs.

ORDER BY TRADE NAME FROM YOUR LOCAL JOBBER

ORIGINATORS AND PIONEERS OF STEEL UNIONS SINCE 1912

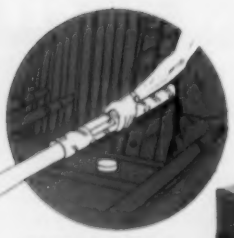
CLAYTON MARK & COMPANY

1900 DEMPSTER STREET • EVANSTON, ILLINOIS

Packaging Pioneers

The primary purpose of Mission's *protective packaging* is to assure you that every Mission Product reaches you in the same performance-guaranteed condition in which it left the Mission plant.

Yes, the real beauty of the Mission package is far more than "wrapper deep." Years ago, Mission pioneered protective packaging for its oil field equipment with the firm belief that good equipment deserves good care to prevent damage during shipment. Recently, Mission was the only oil field equipment manufacturer to receive an award for packaging in national competition. All Mission products are clearly marked so that the products may be identified at a glance. The compact boxes may be more uniformly stacked in stock rooms and supply store shelves than unwrapped parts. The next time Mission Products arrive on your location, notice how carefully they have been packaged for protection en route. This is just one more example of the difference Mission makes that makes a big difference in the performance you get.



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FLUID END PISTONS

PISTON RUBBERS

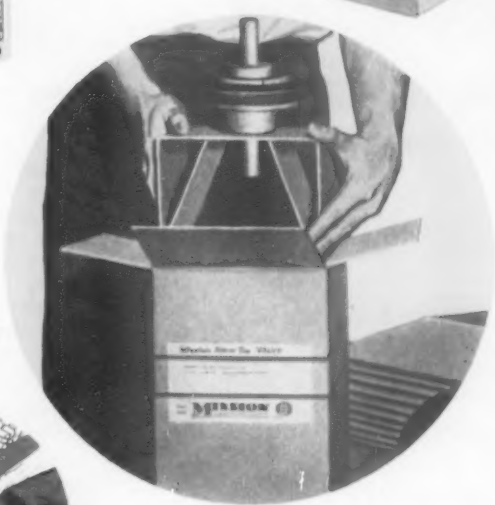
Nothing but the finest will ever bear

VALVE INSERTS

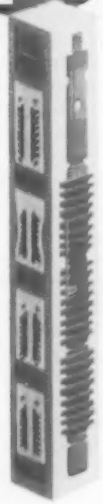
SUPER-SERVICE VALVE SEATS

E-Z SWAB RUBBERS

E-Z SWABS



VALVE SPRINGS



SILVER-TOP VALVES

PLUG VALVES

SLIP DOGS

GLAND PACKING

LINERS NEW AND RENEWED

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MISSION MANUFACTURING CO.

P. O. BOX 4209 • HOUSTON, TEXAS

Export Office: 30 Rockefeller Plaza, New York

first really new development in safety spectacles in years!

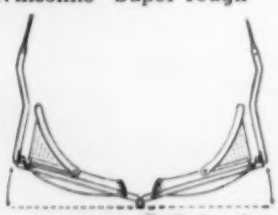
WILLSON "Contour-Spec"*

New... hinged bridge gives snug, comfortable fit... self-adjusting to *any* facial contour!

1. **New hinged bridge** combines the flexibility of cup-type goggles with the lightweight, compact protection of safety spectacles.
2. **One all-purpose size** permits universal fit. Bridge hinge gives automatic adjustment to any bridge width from 18-26 mm.; one eye size—47 mm.—fits everybody. *No need to stock a variety of bridge and eye sizes.*
3. **Plastic nose-and-cheek pads** provide *full closure* around eye cavity.
4. **Contour-shaped** adjustable plastic-and-cable temples hold spectacles firmly in place.
5. **Matching sideshields** are perforated plastic, providing protection at sides—*fold back* for pocket compactness.
6. **Butyrate frame**—*toughest plastic used for spectacles.* Standard frame is flesh colored, fitted with 6-curve Willson Super-Tough® glass lenses. Available also with green frame and sideshields, fitted with Willsonite® Super-Tough green glass lenses.

Hinged to fit any face snugly!

See how the unique hinged bridge allows the Contour-Spec to open up to fit broad faces and close up for narrow faces. It's this feature that allows Contour-Specs to contact the entire eye cavity and makes them fit so comfortably yet securely.



*Trademark

Order a supply of Contour-Specs from your Willson distributor. Let your workers try their amazingly greater comfort, and see how they're preferred over ordinary safety spectacles!

More Than 300 Safety Products Carry This Famous Trademark

WILLSON

Established 1870

WILLSON PRODUCTS, INC., 204 Washington St., Reading, Pennsylvania

and hoists. Bright and galvanized carbon steel, stainless steel, and Monel metal are used for the wire rope. Stainless-steel terminals, mild carbon steel, and drop-forged-steel terminals are swaged to the ends of the rope making a fastening stronger than the cable itself. *Macwhyte Co.*

Check No. 14 On The Time-Saver Card

●

Selas Vape-Sorber. Bulletin No. SC-1047 covers equipment used throughout industry wherever conditioned air and gases are required for maximum instrument accuracy and process efficiency. Available in capacities ranging from 100 to 2,500 cu. ft. per minute, the Vape-Sorber provides continuous removal of petroleum vapors, dirt, and liquids from air and gases. *Selas Corp. of America.*

Check No. 15 On The Time-Saver Card

●

Variable Speed Drive. Bulletin 497 describes a new, single, wide-range-belt, variable-speed drive and shows how to design and select drives for 1 to 20-hp. motors. Wood's variable-speed drive is simple, yet covers a wide range of horsepower with speed ratios up to 3 to 1. Dimensions and list prices are fully covered in this bulletin. *T. B. Wood's Sons Co.*

Check No. 16 On The Time-Saver Card

●

Sucker Rods—Polished Rods—Couplings. This 28-page, perforated bulletin outlines the history of the firm in the sucker-rod field and furnishes complete information on the four types of rods now made by the firm, including carbon manganese, nickel chromium molybdenum, nickel molybdenum, and high-nickel molybdenum steels. The catalog includes charts on pumping-well calculations, fluid and rod weight, correct length of component parts, rod and tubing stretch, and pumping speeds. *W. C. Norris, Manufacturer, Inc.*

Check No. 17 On The Time-Saver Card

●

Aero Commander-560. The flexibility, performance, interior appointments, specifications, and suitability for business traveling of the nominal seven-place, swept-tail plane are featured in a 12-page, multicolor brochure. *Aero Design & Engineering Co.*

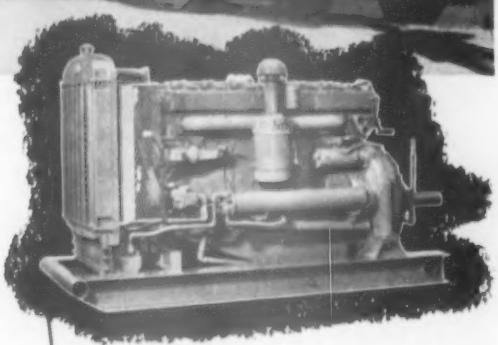
Check No. 18 On The Time-Saver Card

●

Hyreco Processing Units. Bulletin H-9-54 is a revised catalog on Parkersburg's Hyreco cold separation unit, a complete

"MURPHY DIESELS are the answer to the driller's problem . . . no repairs . . . a lot of power"

says: James E. Armstrong,
Manager
DRILLING AND PRODUCTION COMPANY
BAKERSFIELD



DRILLING AND PRODUCTION CO.
528 WEST SIXTH STREET
LOS ANGELES 14, CALIFORNIA
2907 L STREET, BAKERSFIELD
TELEPHONE 8-0955

Glenn Rose Engine Service
502 South Real Road
Bakersfield, California

Gentlemen:

Our Murphy Diesels Model 112 and 122 driving an Oilwell Pump 214P (7-1/4 liners) at 70 to 75 strokes per minute are now over a year old. They have worked in excess of 300, 24 hr. days with no repairs whatsoever. The only parts purchased have been filters and fan belts. The Murphys have a lot of power to spare. Our pressures and volume have been more than satisfactory under the most extreme conditions.

The fuel consumption has never exceeded 17 gallons per hour. Our average consumption at 5000' with 7-1/4" liners, are as follows: 850 psi at 63 SPM or 300 hydraulic H.P. We believe Murphy Diesels are the answer to the driller's problems.

Very truly yours,

DRILLING & PRODUCTION CO.

James E. Armstrong

James E. Armstrong, Manager

JEA:re

• Mr. Armstrong's own words tell far better than we could why so many drillers are turning to Murphy Diesel power. And Mr. Armstrong's words echo the statements of Murphy Diesel users everywhere. Drillers particularly like the dependable, trouble-free service, the freedom from costly downtime and the fuel economy they get from Murphy Diesels. You can put these advantages to work for you. Just call your Murphy Diesel Dealer. He'll give you all the facts.

MURPHY DIESEL COMPANY

5305 W. Burnham St. • Milwaukee 14, Wisconsin

***FACTORY BRANCH—Sales, Parts and Service:* 113-117 So. Elwood St., Tulsa, Oklahoma**

Engines and power units 90 to 260 H.P.; dual-fuel engines, 135 to 215 H.P.

303

MURPHY DIESEL

SEE YOUR MURPHY DIESEL DEALER, TODAY—

ALBUQUERQUE, NEW MEXICO, Lively Equipment Company; BUTTE, MONTANA, Hall-Perry Machinery Company; CORPUS CHRISTI, TEXAS, Houston Engine & Pump Company; DALLAS, TEXAS, Conley-Lott-Nichols Machinery Co.; DENVER, COLORADO, Power Equipment Company, EDMONTON, ALBERTA, CANADA, Northern Engine & Equipment Co., Ltd.; GREAT BEND, KANSAS, Manufacturers Dist. Co.; GREAT FALLS, MONTANA, Hall-Perry Machinery Company; HOUSTON, TEXAS, Houston Engine & Pump Co., Inc.; JACKSON, MICHIGAN, Utility & Industrial Supply Co.; LOS ANGELES, CALIFORNIA, Industrial Engine Service; LUBBOCK, TEXAS, Conley-Lott-Nichols Machinery Co.; SAN ANTONIO, TEXAS, The Roy Klossner Company; BAKERSFIELD, CALIFORNIA, Glenn Rose Engine Service; ODESSA, TEXAS, Conley-Lott-Nichols Machinery Co.; LONGVIEW, TEXAS, Nichols Machinery Co.

TULSA, OKLAHOMA, SALES, PARTS AND SERVICE.

*Les Affairs ou le plaisir a Tulsa dire le Mayo Veulent!

600 AIR CONDITIONED ROOMS, ADJACENT GARAGE, Wonderful FOOD AND SERVICE

*TRANSLATION

Business *and* Pleasure in Tulsa

means - THE MAYO

TULSA'S *world-famous* HOTEL

and unitized high-pressure gas-well hookup. It consists of a high-recovery separator; a heat exchanger; a wellhead knockout; controls; a second-stage flash chamber; and prefabricated piping. Line drawings illustrate the flow pattern of several types, and elevation and plan drawings clearly illustrate typical units. An engineering section includes charts on wellhead data. *The Parkersburg Rig & Reel Co.*

Check No. 19 On The Time-Saver Card

●

Job-Engineered Pumps. This new eight-page bulletin, No. 735-1 features characteristic curves on each of a number of pumps. These graphs can be used as a selection aid in choosing the right pump for a specific job. *A. O. Smith Corp.*

Check No. 20 On The Time-Saver Card

●

Controlled Liquid Entrainment Includes Detailed Design and Engineering Data on the Metex Mist Eliminator, a wire-mesh separator that, under proper operating conditions regularly removes over 99 per cent of the liquid entrainment present in gases. Metex mist eliminators can be made from practically any metal that can be drawn into wire. They are available from mill stock in Types 304, 316, and 430 stainless steels, monel, nickel, aluminum, brass, copper, and steel. *Metal Goods Corp.*

Check No. 21 On The Time-Saver Card

●

Recording Automatic Controlling-Telemetering Instruments. A new general bulletin, DMO35, lists and illustrates the complete line of recording automatic controlling and telemetering instruments manufactured by Bristol Co. The bulletin features the new line of Metagraphic pneumatic transmission instruments, which divide the functions of measuring, recording, and controlling into three separate instruments to achieve maximum flexibility in application. The bulletin also illustrates and describes briefly the full line of recorders and controllers for temperature, flow, liquid level, mechanical motion, running time, count, operation, and speed. *Bristol Co.*

Check No. 22 On The Time-Saver Card

●

Peerless Vertical Industrial Sump Pumps. Industrial service-pump bulletin No. B-100 completely describes all three Peerless types. The 16-page, illustrated bulletin contains new engineering data on sump ranging in capacities from 30 to 40,000 g.p.m. with heads up to 1,000 ft. *Peerless Pump Division, Food Machinery & Chemical Corp.*

Check No. 23 On The Time-Saver Card

●

Orifice Fittings. Catalog No. 54 lists specifications, advantages, and other pertinent engineering data on Type E orifice fittings for low-pressure applications in sizes from 2 to 30 in. and for high-pressure applications from 2

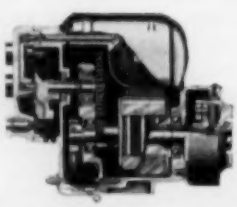
UNLIMITED RUNNING TIME FOR YOUR PUMPING ENGINES

When your pumping engines are equipped with Fairbanks-Morse Super Spark Magnetos be assured they are on the job making money for you day after day. These dependable magnetos are built to deliver efficient, economical and dependable service under the toughest operating conditions—cuts down-time—they rarely need attention or maintenance.

Standardize now on Fairbanks-Morse Super Spark Magnetos and cinch low cost trouble-free performance. See your Fairbanks-Morse service station or distributor or write Fairbanks, Morse & Co., Magneto Division, Beloit, Wisconsin.

ENGINEERED FOR TOUGH SERVICE

- Compact, rugged, self-contained unit—few working parts
- Steady hot spark at all speeds
- Large, long lasting breaker points for quick starts—smooth performance
- Oversize high tension coils—built to take a beating
- Sturdy impulse coupling of simple design for easy starting
- Alnico Super Magnets cast into powerful one-piece magnetic rotor



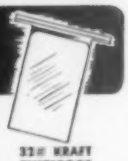
This is type FM-XOR six cylinder magneto with ball bearings throughout—available in base or flange mounting.

FAIRBANKS-MORSE

a name worth remembering when you want the best

MOTORS • ZC ENGINES • MAGNETOS • PUMPS • DIESELS

EMPIRE SAND SAMPLE ENVELOPES



Specially designed and manufactured for storing sand samples. They will last and serve for years. Immediate delivery of any quantity.

PRICES AND SAMPLES ON REQUEST

32# KRAFT RUSTPROOF FLEXIBLE METAL TIE

CORE BOXES

Corrugated boxes for storing Empire Sand Sample Envelopes manufactured to fit your specifications. Inquiries for any size and quantity solicited.

TULSA PAPER CO.

P. O. BOX 30 TULSA 1, OKLA

to 6-in. pipe sizes. *Robinson Orifice Fitting Co.*

Check No. 24 On The Time-Saver Card

●

Application of Infrared Methods to Light Hydrocarbon Gas Analysis. A 12-page illustrated paper outlines the application of infrared methods to light hydrocarbon gas analysis. Most of the paper is given over to a detailed example of the procedure and calculations involved in a typical five-component analysis. The paper also outlines the advantages of infrared and mass spectrometer methods, describes the infrared instrumentation required for typical light hydrocarbon gas analysis, and the services and laboratory space needed. *Perkin-Elmer Corp.*

Check No. 25 On The Time-Saver Card

●

Type R Polished Rod Stuffing Box. Data sheet includes a line drawing nomenclature, prices, and operational information on types R-1 and R-2 designs. Type R-2 is similar to R-1 except that R-2 carries rams which assure positive leakproof shutoff on the polished rod when new oil pads or packing rings are installed. *Drovil Co.*

Check No. 26 On The Time-Saver Card

●

Norco Refinery is the title of the leading article in the September-October issue of Heat Engineering, an external house organ. Shell Oil Corp.'s Norco, (La.) refinery now incorporates a fluid catalytic-cracking unit with the world's largest charging capacity, 72,000 bbl. per day. The article covers design and construction of this unit. *Foster Wheeler Corp.*

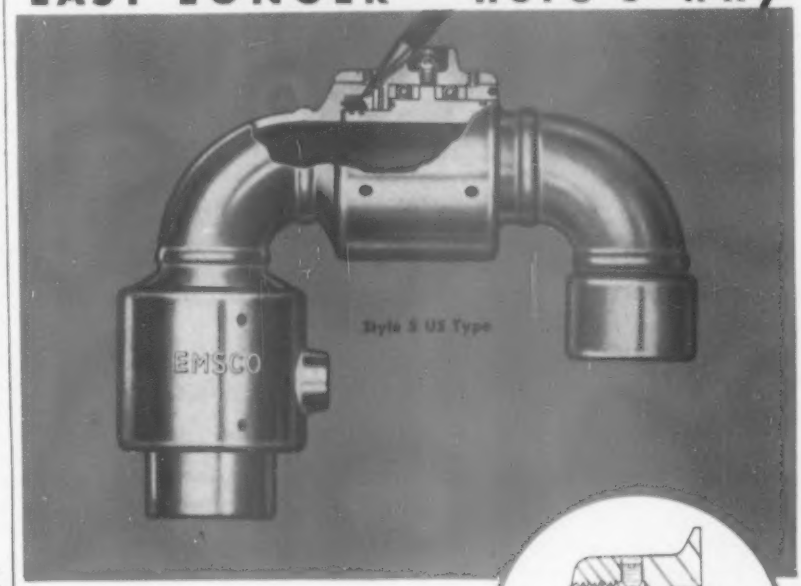
Check No. 27 On The Time-Saver Card

●

York-Mesh Demisters Cut Compressor Maintenance. Two case histories, 1005 and 1006, reported in a new pamphlet, tell how a monel wire-mesh demister was installed in the compressor-suction drum of a deasphalting unit at a Gulf Coast refinery to reduce high maintenance costs on propane compressors, and how installation of a monel wire-mesh demister pad in the compressor-suction line of the catalytic cracking unit at a Midwest refinery completely stopped the excessive maintenance which resulted from dilution of valve lubricants by liquid entrained in the gas stream. *Otto H. York Co., Inc.*

Check No. 28 On The Time-Saver Card

EMSCO SWIVEL FITTINGS LAST LONGER — here's why



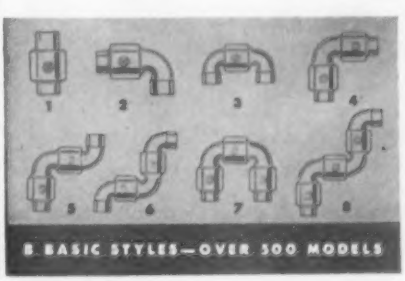
UNIQUE DESIGN PERMITS EASY MAINTENANCE WHILE IN OPERATION

Three basic advantages of the Emsco Ball Bearing Swivel Fitting are:

1. FREE TURNING
2. EFFICIENT PACK-OFF
3. LONG LASTING

An Emsco Swivel Fitting is practically unexpendable for the reason that, after long service, both the packing and the ball races are easily adjustable and replaceable. This means no discarded fittings—no costly return to the factory for repairs.

Emsco "free turning" Ball Bearing Swivel Fittings are manufactured for almost every type of service, from high vacuum to pressures of 15,000 psi., and from sub-zero temperatures to 750°F. Complete information, prices and delivery upon request.



Deformable packing extruded into annular grooves assures a positive seal. This Emsco patented method does not affect ease of turning. Any packing material such as asbestos, Blue African Asbestos or Teflon may be used in the US Type fitting.

Fittings using a lip type packing are available as Type HS or HP, depending on pressure involved

LIP TYPE PACKING

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MANUFACTURING COMPANY

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EQUIPMENT MEN . . . in the News

Magcobar's new office and laboratory building at Houston.

Magcobar Opens New Office and Laboratory Building

With the opening of a new office and laboratory building in Houston recently, Magnet Cove Barium Corp. began a new service to the oil industry. The new facilities will enable Magcobar to give better mud service in the future and exemplify years of accomplishment for the company which was founded in 1940 in Magnet Cove, Ark., by Willard M. Johnson and Harry B. Brown.

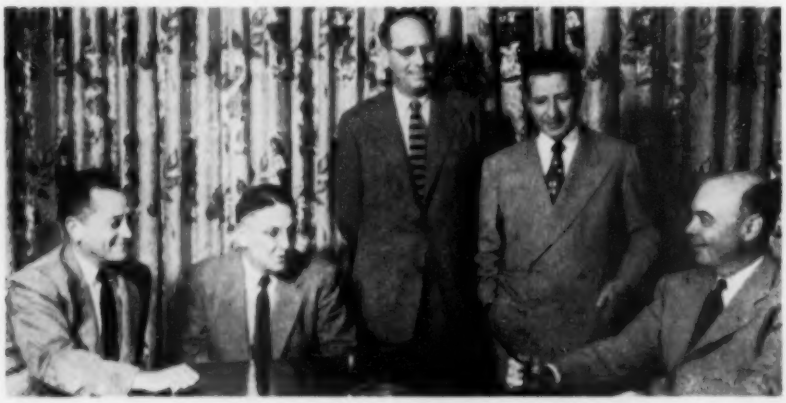
The new building is located in one of Houston's newest industrial sections, is of lift-slab construction, and has an area of 29,360 sq. ft. It houses general and executive offices, a research library, various laboratories, and a snack bar. A detached garage has an area of 3,400 sq. ft.

Magcobar's resources today far surpass the original mine at Magnet Cove. The deposit at Magnet Cove still furnishes the major part of Magcobar mud weight. High quality ore is processed at the mill in Malvern, Ark., 12 miles from the mine. A giant seven-story furnace was installed at the mill last year. It stands 70-ft. high and measures about the same footage around its midsection.

To increase its facilities for the production of Magcobar mud weight, two new barite plants were built last year. The first of these is located in Brownsville, Tex., to serve the southern Gulf Coast area, Mexico, and South America. The other new barite plant is located in New Orleans. In addition to these plants Magcobar has clay-mining facilities at Zavalla, Tex. Plants for manufacturing oil-mud and oil-emulsion compounds are located at Houston and Odessa, Tex., and New Iberia, La. Feeder warehouses to assist the dealer organization, are located in New Orleans, New Iberia, Houston, Corpus Christi, Tex., Casper, Wyo., and Olney, Ill.

In November 1949 Magcobar became a subsidiary of Dresser Industries, Inc. Willard Johnson was elected a director of Dresser in November 1950 and was named vice president of the parent company in June 1953.

Present officers of Magcobar are: Willard Johnson, president; Orien Van Dyke, vice president; George Moore, sales manager; Floyd Enz, comptroller; and Charles Talbot, production manager.



Officers of Magcobar, pictured left to right, are: George Moore, Orien Van Dyke, Charles Talbot, Floyd Enz, and Willard Johnson.

Pacific Tube Co. Breaks Ground for Expansion

Recently Pacific Tube Co., Los Angeles, broke ground for a major expansion of its stainless-steel tube-pickling facilities. E. H. Lloyd, president, stated that the new expansion will double Pacific's stainless-steel pickling capacity. The facilities were designed by Albert C. Martin and associates of Los Angeles in connection with Pacific Tube's engineering department. The construction will cost approximately $200,000.00.

Pacific Tube, manufacturers of steel tubing and bars, expects to have the new facilities in operation by mid-February.

Rockwell Names Managers, Opens District Offices

E. D. PROPPS

H. M. LOGAN

DEAN COLLINS

Rockwell Manufacturing Co.'s Meter and Valve Division has named three new district managers in the South and Midwest, and has established a new district office at Shreveport, La., as well as a new West Texas branch office at Midland, Tex., and converted its Dallas sales office into a district and regional headquarters office.

The three new district managers and their districts are: Edward D. Propps, Dallas; Herbert M. Logan, Tulsa; and Dean Collins, Shreveport. Propps and Logan, both sales engineers, succeed respectively W. R. McLaughlin of Dallas and Roy R. Bush of Tulsa, who were appointed to new regional managerships several weeks ago.

Propps joined Rockwell as a sales engineer. He had earlier industrial experience as a foreman with the Triangle Drilling Co. from 1939 to 1942, and as an engineer with Texas Sheet Metal & Manufacturing Co.

Logan, who joined Rockwell in 1934 as a sales engineer, has spent a year with Stanolind Pipeline Co. following graduation.

Collins became associated with Rockwell in 1935 as a repairman in the Tulsa district shop and became a sales engineer in that district the following year. He had previously worked for Roxana Refining Co., Derby Refining Co., Phillips Petroleum Co., Skelly Oil Co., and Barnsdall Oil Co.

According to L. A. Dixon, Jr., vice president, the newly created Shreveport and Dallas districts, together with the existing Houston district and West Texas branch, will make up the nucleus of the new southwestern sales region created several weeks ago by a division of the former midwestern sales region. The new, smaller midwestern sales region created by the division will include the Tulsa and Kansas City districts, the latter still headed by M. D. Gilbert as district manager.

Brooks Becomes Consultant For Parkersburg Rig & Reel

P. L. BROOKS

Paul L. Brooks, assistant to the vice president of sales, has retired recently for reasons of health, it has been announced by W.V. Rathbone, executive vice president of Parkersburg Rig & Reel Division of Parkersburg-Aetna Corp. Brooks will continue his association with the company in a consulting capacity, and as a special sales representative for Parkersburg products.

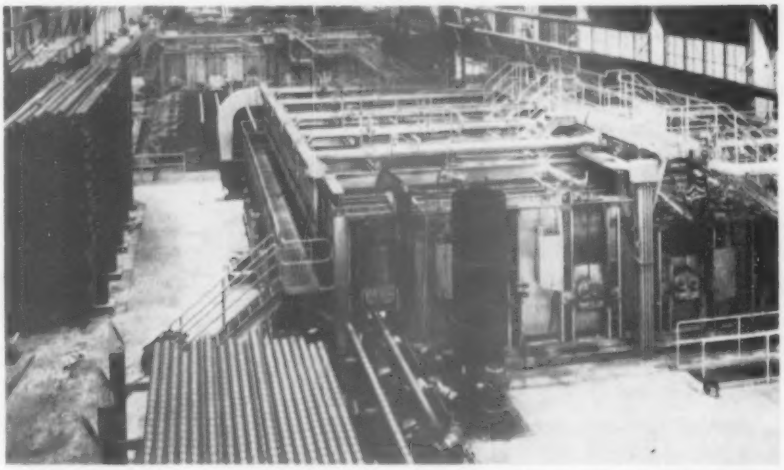
Brooks began his career with Parkersburg Rig & Reel Co. 38 years ago as an office boy in the general offices in Parkersburg, W. Va. Working his way through various departments of the company, he was transferred to the sales department. During his tenure of employment, Brooks has been sales manager, manager of the southern division, and Pacific Coast manager.

Welex Names Haynes To Pampa Assistant Manager

J. E. (Gene) Haynes has been appointed assistant district manager of the Pampa district of Welex Jet Services, Inc., the Fort Worth oil-well service company announced recently.

Haynes has worked for Welex 2½ years and was employed as sales engineer prior to this promotion. Previous to his Welex employment he had several years' experience in the oil field.

J. & L. Opens Seamless Tube Specialties Department



Over-all view of the seamless-tube specialties department at Jones & Laughlin Steel Corp's Aliquippa plant.

New finishing facilities for producing oil-country tubular products in the high strengths necessary for deep drilling are now in operation at Jones & Laughlin Steel Corp.'s Aliquippa, Pa., plant.

The new facilities are housed in a new 100 by 725-ft. steel structure with corrugated siding, built north and west of the 30-in. seamless round mill and seamless tube mill buildings. The new structure, called the seamless-tube specialties department, is the first step in expansion of facilities for finishing high-strength and special seamless-tube products used in the oil industry. Further expansion of these facilities will come under J. & L.'s plans for a $51,000,000 expenditure on this project and other projects in 1955.

In the new specialties department, equipment of J. & L. design makes possible finishing of seamless oil-country casing and tubing by quench and temper heat treatment, imparting to these products characteristics that formerly were attained through adjustments in the chemical composition of the steel. By speeding up and improving the finishing facilities, the new installation will tend to increase the total output of high-strength seamless pipe. Cooperating in the design of this new unit were J. & L. research, technical services, production, and engineering departments.

J. & L. has been making oil-country tubular goods for over 30 years of its 101-year history. Besides seamless casing, tubing, and drill pipe, J. & L. also produces seamless and welded line pipe, all at Aliquippa.

C. T. Hapgood is J. & L.'s manager of tubular products. Oil-country pipe is sold through district offices and J. & L.'s supply division which operates stores in the United States and Canada handling a complete line of oil-country materials and equipment. Rainey Elliott is general manager of the supply division, with headquarters in Tulsa.

This 9⅝-in. seamless J. & L. tubing is ready for shipment. The tubing has a wall thickness of ⅝ in. and ranges in length from 18 to 45 ft. The man shown checking the pipe is Charles Psomas.

Cameron Iron Purchases B.O.F.E.C. Capital Stock

Herbert Allen, vice president and general manager of Cameron Iron Works, Inc., Houston, has announced from London, the conclusion of negotiations for the purchase by Cameron of the entire capital stock of British Oil Field Equipment Co., Ltd., from Heenan & Froude and Brush Group, British industrialists.

B.O.F.E.C. properties are located in England, with general sales offices in

the Time & Life Building, New Bond Street, London, and the manufacturing plant in Leeds. B.O.F.E.C. is well known throughout the sterling area as a manufacturer and marketer of oil-well-drilling and producing equipment. In 1950 Cameron entered into a license agreement with this British firm under which blowout preventers, mud valves, well heads, and Christmas-tree fittings were manufactured and sold to oil operators within the sterling area.

In making this announcement, Allen stated that the B.O.F.E.C. manufacturing facilities in England will be expanded and modernized and adequate stocks of all Cameron products will be maintained at all times to assure immediate delivery.

The company will continue to operate under the name of British Oil Field Equipment Co., Ltd. Edward M. Benjamin of London will remain as managing director and some personnel from the Cameron organization in Houston have already been transferred to the English subsidiary. The board of directors consists of J. S. Abercrombie, chairman, Herbert Allen, Ralph H. McCullough, and O. L. Lorehn, all of Houston, as well as Peter Marriage and Edward M. Benjamin of England.

Kirtley Joins Nalcat In Gulf Coast Area

Bruce C. Kirtley, formerly with M. W. Kellogg Co., recently joined catalyst division of National Aluminate Corp. in a technical sales capacity. Headquartering in Houston, he will represent Nalcat in the Gulf Coast area.

A member of Kellogg organization for 8 years, Kirtley was engaged in catalytic-cracker design and more recently, in the supervision of new-unit startup operations.

Prior to his association with Kellogg, Kirtley was affiliated for 13 years with Shell Oil Co. He has had some 21 years of experience in refinery processing.

Satterlee Joins Dresser

G. C. Satterlee has joined Dresser Industries, Inc., as a project engineer with headquarters in Dallas, upon his resignation as sales engineer from National Supply Co., at Abilene, Tex. Satterlee is a graduate in mechanical engineering from Oklahoma A. & M. College.

Glitsch Holds Sales Conference in Dallas

Fritz W. Glitsch & Sons, Dallas, fabricators of Glitsch Truss-Type trays and other refining and chemical-processing equipment, held its annual sales conference in Dallas recently. These annual meetings also include a study of current developments in varied applications of the company's production in both petroleum and chemical fields. Those attending were: bottom row, left to right: Hans C. Glitsch, Julian Tunno, Bob Fowler, Bryan Ross, and Fritz W. Glitsch, Jr. Top row: S. G. Higginbotham, Nat Nesbitt, Gordon Lindskog, Bob Allen, and Roger Greenman.

Armco Announces Shifts In Management Level

Changes involving several steel men well known throughout the Southwest have been made in the high-level management of Armco Steel Corp. and Armco's Sheffield Steel Division.

R. L. Gray, Sheffield president since 1931, has been elected executive vice president of Armco, with headquarters

R. L. GRAY

J. W. ANDERSON

W. S. NEWELL

R. W. DAVISON

in Middletown, Ohio. John W. Anderson, vice president in charge of sales and related activites with Sheffield, has been elected to replace Gray as Sheffield president. These advancements have been announced at Middletown by Armco President W. W. Sebald, at the same time that two Middletown officials, Vice Presidents H. H. Tullis and R. S. Gruver have been made administrative vice presidents.

Gray, as executive vice president, announced that W. S. (Whip) Newell, sales manager in Sheffield's Houston division, has been appointed to succeed Anderson as vice president in charge of sales, with headquarters in Kansas City. R. W. Davison, assistant sales manager in the Houston division, succeeds Newell as sales manager.

Oilwell Opens Store, Shifts Men In Rocky Mountain Area

Opening of a new branch store at Medicine Lodge, Kans., and reassignments for three men were recently announced by Mark Barkhurst, Mid-Continent area manager for U. S. Steel's Oil Well Supply Division.

A combination branch store and warehouse, the new unit, was established to expand Oilwell's service to the rapidly expanding drilling and production activities in that area, according to Barkhurst.

At the same time, the appointments of Raymond H. Miller as store manager and Lewis Y. Poland as field representative at Medicine Lodge, as well as the transfer of Phil L. Lynn, field representative, from Cushing to Lindsay, Okla., have been announced by Barkhurst.

Miller joined Oilwell in 1948 at El Dorado, Kans., after 6 years of experience with oil companies. In 1952 he transferred to Stafford, Kans., as store manager, the position he held until his new appointment.

Poland was employed by Oilwell in 1947 at Ellinwood, Kans. He transferred to Russell, Kans., the following year and since 1952 has served as field representative in Ellinwood.

Lynn became associated with Oilwell in 1950 at Healdton, Okla. The following year he transferred to Cush-

ing and was promoted to field representative there early in 1954.

Lane-Wells Opens Branch At Woodland, Calif.

To serve the increasing needs of the South Sacramento Valley field, due to the mounting activity in that area, Lane-Wells Co. has opened a new branch in Woodland, it has been announced by W. J. Taylor, Bakersfield, Calif., district superintendent. This location has been selected as the strategic center for the quickest service to all parts of this area.

The new branch is fully equipped to provide perforating service and well-logging service on a 24-hour-a-day basis. The branch is under the direction of Joseph L. Newman, Elwood B. Harris, and Paul D. Knox, all experienced Lane-Wells personnel.

Pritchard Announces Management Promotions

J. F. Pritchard, president of J. F. Pritchard Co. of Kansas City, has announced several promotions within the organization.

H. Arthur Martin has been appointed executive vice president. New vice presidents are W. Earl Dunn, H. M. Low, A. Russell Young, W. W. Deschner, Karl E. Johnson, vice president and general manager, J. F. Pritchard Co. of California, as well as H. R. Oglesby, vice president and general manager, Municipal Service Co.

The Pritchard organization serves as engineers, constructors, and manufacturers for the petroleum, power, chemical, and natural-gas industries.

Benda, Amend Assigned To Houston by Willis Oil Tool

R. F. BENDA

R. S. AMEND

Robert F. Benda has been appointed district manager in the Gulf Coast area for Willis Oil Tool Co., Long Beach, Calif. Benda will be in charge of sales and stocks of the complete Willis line of chokes, rotary flow beans, arc rod, tubing, and rotors at Houston.

R. S. Amend has been transferred from the Willis factory at Long Beach to the Houston branch as assistant to Benda. He will specialize in field-engineering application and service from the Houston office.

Benda is a graduate engineer and for the past 11 years has been engaged in oil-industry equipment-engineering sales work in the Southwest.

Wyatt Metal & Boiler Honors 25-Year Employes

Employes who have been with Wyatt Metal & Boiler Works 25 years and longer were recently honored with a dinner in the Baker Hotel, Dallas. Ralph W. Malone, vice president and chief counsel, presided. Guests got a history of the early days of the company from Charles R. Moore, a director and the only living man of the five who incorporated the concern in February 1913.

Raleigh Hortenstine, president and one of the 25-year men, gave watches to the following in recognition of service with the company: W. F. Ebert, Inge Grant, W. H. Hare, Sr., Edward Haynes, B. C. High, Bill Holand, W. D. Jimerson, L. A. Lindsey, C. R. Moore, C. I. Motes, W. A. Perry, F. T. Pirkle, W. C. Ray, R. C. Rogers, Ilo Royal, Matt Stricklin, and F. B. Swift, all of

1954-55 DIRECTORY

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Dallas. Those honored from Houston included T. J. Dahl, Guy Cambrell, L. M. Goth, Roy Hall, C. B. Hays, E. C. Jones, W. Jones, L. G. Jordan, W. McDugle, Louie McLaran, C. E. Morton, Richard Nossek, T. I. (Pat) Patrick, R. M. Pugsley, C. W. Rogers, Sr., W. B. Van Wart, and R. H. Wilson.

B. J. Service Enters Radiation Logging Field

B. J. Service, Inc., Long Beach, Calif., has been licensed to run the simultaneous radiation log of Perforating Guns Atlas Corp. This announcement has been made by John B. Merritt, executive vice president of B. J. Service.

The new program was initiated last summer when four B. J. Service engineers were indoctrinated in simultaneous radiation logging at Houston. W. D. Sauer, Glendive, Mont., W. R. Wilson, Casper, Wyo., W. H. Spidell, Hobbs, N. M., and H. A. Ortmayer, Long Beach, Calif., made up the first contingent to undergo training on the most recent features of simultaneous radiation logging.

The first logging units will be placed in service in the Rocky Mountains, and present plans are to initiate this service in other areas in the near future.

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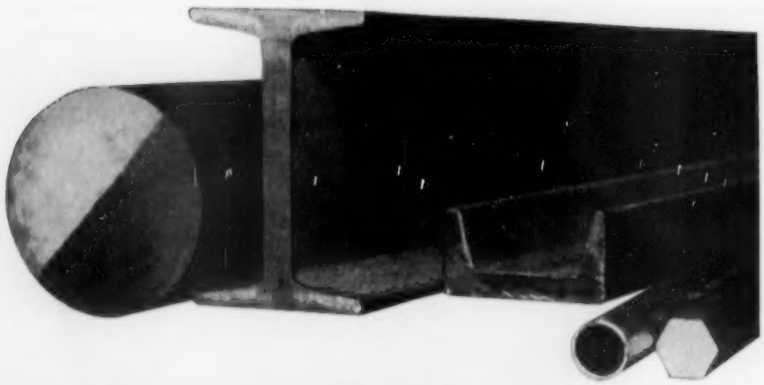

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Link-Belt Names Brinkworth To Head Oil-Field Sales

Link-Belt Co. has announced the appointment of William J. Brinkworth as manager of oil-field sales, a newly created post. His headquarters will be the company's Ewart plant in Indianapolis. James G. Samuell has been selected to succeed Brinkworth in Houston as district manager, oil-field distributor sales. He will be in charge of distributor sales of oil-field equipment in the Mid-Continent area. John R. Sybesma is the new Link-Belt district representative for oil-field sales in Houston, replacing Samuell.

BRINKWORTH

J. G. SAMUELL

Brinkworth started with Link-Belt in 1929 at the Ewart plant, where he worked in the production, pricing, and estimating departments, plus 8 years in sales. He was transferred to Houston in 1946. Samuell, who first joined Link-Belt in 1945, was a sales engineer for oil-field sales. Sybesma, who was transferred from the Ewart plant, will be active primarily in the Gulf Coast area.

Fluid Packed Pump Shifts Lohman to Oklahoma Post

BILL LOHMAN

The promotion of Bill Lohman to Oklahoma district manager has been announced by Sidney Shuman, executive vice president of Fluid Packed Pump Co. In his new position, Lohman will headquarter at Oklahoma City and will assist G. R. Newbolt in supervising Oilmaster pump sales and services.

Lohman joined Fluid Packed Pump Co.'s sales force at Odessa, Tex., in 1947. In 1952 he was transferred to Seminole, Okla.

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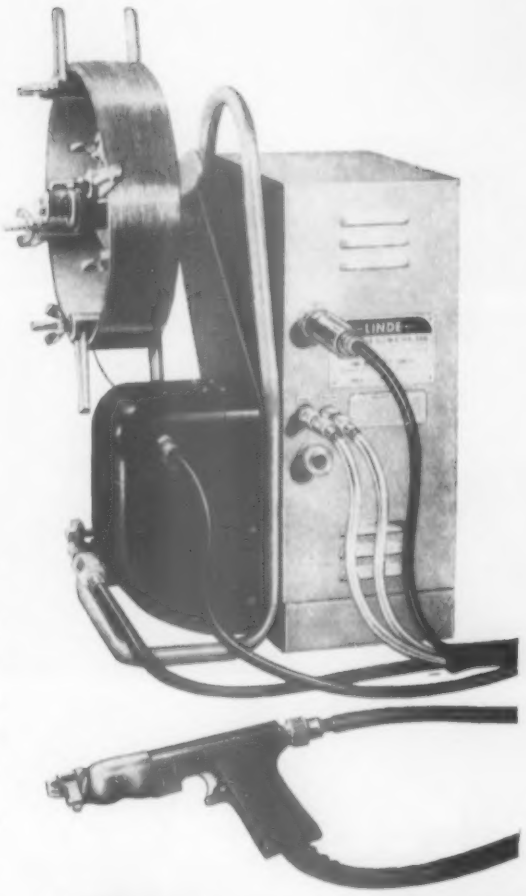

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Production jumped 300% when the Heller Engineering and Manufacturing Company, Lynwood, California changed to sigma welding to fabricate aluminum engine shipping stands. Because the sigma welds were clean and sound, post-welding treatment was practically eliminated.

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EXPLORATION

Hansford County Shows the Way

by Frank J. Gardner

Exploration in Hansford County, Texas has yielded nine separate pay horizons in at least six different new fields, all within a year's time. All are pre-Permian discoveries.

"SPARSE rural population, native white, depending largely on wheat and cattle for livelihood"—that's how the almanacs describe Hansford County, Texas.

But there's news for Poor Richard—all that has been changed in 1954. Hansford has scored heavily this year with one oil strike after another, and today, its rolling wheatlands are dotted with derricks; it is easily the busiest place in the Panhandle area.

Two initial strikes . . . The spark that set off the fire was the isolated wildcat at A on the map. Here, in October 1953, The Texas Co. completed its 1 Blakemore to open North Spearman field; Pennsylvanian-Morrow sands at 7,298-7,370 ft. flowed 6,850 M.c.f. of gas daily to mark the first pre-Permian production in this part of the Panhandle country.

At about the same time, Humble Oil & Refining Co. brought in a Pennsylvanian-Douglas gas well at its 1 East Gruver Gas Unit 1, 10 miles west of the Texaco strike, to open East Gruver field (B on map).

Strike three was oil. Moving 13 miles north of East Gruver, Humble went into an old dry hole, its 1 Collier, deepened it to 7,392 ft., plugged it back to 4,740 ft., and completed it in February of this year as a 16-bbl. pumper from Douglas sand at 4,639-43 ft. This opened Hitchland field (C on map), 2 miles off the flank of the big Hugoton gas field.

Rapidly, Humble expanded Hitchland to the northeast with a 1¾-mile gas extension and a 2¼-mile oil extension, both Douglas producers. In July, a 3-mile southwest extension and new pay strike was scored by United Producing Co. at its 4 Jackson, a Morrow gasser at 6,586-6,606 ft.

Back in the East Gruver area, Humble achieved two new oil discoveries: the 1 Crowe, producing from Pennsylvanian-Kathryn pay at 6,185-6,205 ft., and the 1 Wilbanks, a Pennsylvanian-Canyon oiler at 5,975-88 ft. Both were small producers, but they established multiple-pay prospects at East Gruver on a scale not previously suspected.

Linking fields . . . Meanwhile, about 4 miles east of the Humble activities, R. H. Fulton had opened a new gas area at his 1 Matthews, a Morrow sand producer at 7,062-74 ft.; immediately west of this discovery, Fulton found Pennsylvanian-Atoka gas at 6,904-78 ft. with his 1 Jackson. Last week, two Humble wells, the 1 Gruver Gas Unit 7 and the 1 Gruver Gas Unit 8, gave indications that these Fulton wells would be linked with the Humble wells at East Gruver, as gas flows from the Morrow were recorded at 6,931-45 ft. in 1 G.G.U. 7. Added importance was given the East Gruver play by discovery of the first Pennsylvanian-Cherokee gas at Sharples Oil Corp. 1 Henderson (northernmost East Gruver field well on map).

While all this development was going on, more gas was found to the northeast at D on the map; this discovery, Colorado Oil & Gas Co. 1 Steele, flowed 4,800 M.c.f. of gas daily from Pennsylvanian-Tonkawa sand at 5,256-68 ft.

And the biggest oil well . . . But the best was yet to come. Two new fields, at E and F, have appeared on the scene since November 1, and one (Twin field) promises to be a whopper. Here, the discovery well, Fulton's 1 Lasater, was widely hailed as the best oil well ever found in the county when it came in for 498 bbl. per day from Morrow perforations at 7,040-50 ft.—the best, that is, until Fulton 2 Lasater overshadowed it with a potential of 1,296 bbl. of oil and 1,000 M.c.f. of gas daily. This was the largest oil well ever found in the Anadarko basin area of the Panhandle, and it definitely projects Hansford County into the major oil-producing category.

The list of "firsts" was topped once more when Humble 1 Oil Development Co. of Texas (F on map) found the first Mississippian-Chester gas production in the county; this discovery, halfway between East Gruver and Twin fields, flowed 1,500 M.c.f. of gas per day from perforations at 7,650-76 ft. to give the county its ninth pay formation.

Predict a campaign . . . All this has happened in less than a year—what will happen in 1955? Undoubtedly, an exploration program that will dwarf this year's is in store for Hansford and its neighbors. The lease-ownership map of the county shows no huge blocks, no preponderances of any kind. Independents, majors, and "semimajors" alike are represented. That means a lively campaign lies ahead. It means that the prize-winning wheat fields of Hansford County are in for an oily invasion, but it will no doubt be a welcome one for the "sparse rural population, native white, depending largely on wheat and cattle for livelihood." It means more prosperity for an already prosperous land.

Have You Any Oil Fields Hidden in The Curves of Electric Logs on File?

"There is no richer hunting ground for oil or gas"

by Dr. R. G. Hamilton

EXPLORATION for oil and gas is normally and logically considered as being a job in the field. Surface indications, seismic information, magnetic and gravimetric as well as other exploratory tools reveal conditions favorable to oil accumulation. But an increasing amount of exploration is being done at a desk with electric logs, a slide rule, reams of paper, and a backlog of experience.

Possibly not as spectacular as the field work, the search for new oil and gas fields among the curves of electric logs is producing increased headlines in the oil press.

From past results that are a matter of record, discoveries of new oil and gas can be made from proper analysis of electric logs.

Field is broad . . . Any operator or group of partners having 100 or more electric logs—either their own or available to them in a multiple-pay area—quite probably has at least one oil field and another gas field hidden in the curves of the electric log file. This is particularly true of plugged wildcat and semiwildcat wells. There is no richer hunting ground for oil or gas.

The circumstance of electric logs becoming a fertile field for exploration evolved naturally. It does not mean that operators have been inept or wrongly advised except in a few instances. It does mean that our industry has been accumulating valuable information for years and that now technology has reached a level of development that permits reasonably accurate evaluation of a backlog of electric-log data.

Exactly how this is possible is not the purpose of this article; the results rather than the methods are here discussed and the data here presented are practical rather than technical.

For 20 years, since the introduction of the simple, two-curve electric log into this country on a commercial scale in 1934, hundreds of thousands of recordings have been made. Yet it is estimated that only 25 per cent, and certainly not more than 50 per cent, have been thoroughly examined for the oil and gas they may indicate. The plugging of potential discovery wells has made the electric log an excellent oil-finding tool. It just so happens that advanced methods of electric-log interpretation come at a time when economic conditions within the industry support the trend in this direction.

The search for oil is not and probably never will be an "exact" science. Since the first well was drilled, countless tests have been abandoned as failures when, in fact, they could have been completed as discoveries. There are a variety of reasons.

Reasons for Intentionally Plugging

Occasionally a discovery is shut down and at least temporarily plugged so that the operating firm can strengthen its ownership situation.

Disagreement among partners, and at times among the technical experts, may result in failure to agree on testing and completion procedures with an order to plug finally coming from the one with the most authority.

There have been times when it was more profitable, under certain conditions, to plug a discovery than to complete it as a producer. Also, the natural potential, the allowable, the price, and — unfortunately — prejudice and professional pride have helped plug some wells.

In addition to the intentional reasons for plugging a potential discovery, there are even more reasons why a discovery may unintentionally be abandoned.

Probably the most general of these results from a complete lack of testing information. They may be cataloged as follows:

1. Samples either not taken or not saved.
2. Cores either not taken or not analyzed.
3. Cores taken in wrong places.
4. Impossible to core due to hole conditions.
5. No drill-stem tests made.
6. Impossible to drill-stem test due to hole conditions.
7. Drill-stem test failed.
8. No electric log was recorded.
9. Electric log could not be obtained due to hole conditions.
10. The well did not blow out.

Information Ignored or Misinterpreted

1. No "shows" in samples. Very-high-porosity, clean sands sometimes have no shows. Gas and gas-distillate-bearing formations can be missed due to no shows.
2. "Shows" in samples were misinterpreted and well plugged.
3. Core analyses misinterpreted.
4. Drill-stem test taken below an oil "show" in samples.
5. The bit may be 20 to 50 ft. below the oil show in samples before the cuttings reach the surface. Often the drill-stem test then taken is in a lower salt-water section or even shale. This difficulty is very common in fast-drilling rock country.
6. Drill-stem tests, for similar reasons, often "straddle" an oil-water contact. If part of the water section is included in the test, the water usually beats the oil out and only a slight oil show may be obtained. Hundreds of oil-producing formations just above water have thus been plugged.
7. Drill-stem test produced only a small volume of fluid, principally mud. Drilling water swells clay minerals and most dirty sands give poor drill-stem tests. Fracturing methods are opening up many new oil pools in such formations thus condemned.

THE AUTHOR

Dr. R. G. Hamilton, consultant, Tulsa, has more than 20 years of experience in well-log interpretation and analysis. He formerly was Oklahoma manager for Schlumberger Well Surveying Corp., which he joined in 1935. Widely recognized for reinterpretation of electric logs of old wells, with the result that new fields were discovered, he has conducted his consultive work throughout the Western Hemisphere.

Hamilton obtained a degree in geology at De Pauw University, and later earned master's and doctor's degrees in geology at the State University of Iowa. This paper was presented at the annual meeting of I.P.A.A. in Tulsa, October 26, 1954.

8. Drill-stem tests of too short duration. There is the famous drill-stem test in the Rockies that produced fluid after being open 18 hours, and resulted in a new discovery. On the sixteenth and seventeenth hour it appeared to be another dry hole.

Mechanical Failures

1. Incorrect depth measurements.
2. Difference between logging and perforating depths.
3. Perforations in the wrong formation.
4. Perforations made in salt water below the oil column.
5. Casing accidentally set through the porous oil bed.
6. Casing set above the bed to permit entry of a foreign water.
7. No cement behind pipe where perforated.
8. Channeled cement behind perforations.
9. Split pipe from shooting permits water entry from foreign source.
10. Leak in casing permits water entry from foreign source.

Electric Log ignored or misinterpreted . . . In this discussion we are primarily interested in the reasons why the electric log failed to find the oil. The log recording is usually the last operation in a hole, before plugging, and frequently represents the last hope for finding oil or gas. Why has it sometimes failed?

Complete Lack of Interpretation

1. Thousands of logs have been recorded—sometimes because of a dry-hole contribution—and placed in the files with hardly a second glance.
2. For years many people regarded the log as a correlation tool only, rather than as a potential oil-finding tool.
3. When the total depth of a well is reached everyone gets in a frenzied hurry to either plug the well or run pipe immediately. Sufficient time for proper evaluation of the log is seldom permitted. However, some companies are now shutting down the rig until a thorough analysis is obtained.
4. Ability to properly analyze the logs has been inadequate.

Log interpreted correct but ignored . . . Many logs have been interpreted properly but someone in authority is over cautious and may have lacked confidence in logs.

Miscellaneous Reasons for Misinterpretation of Logs

1. Quantitative methods or relatively new.
2. Older logs had only two curves. These may now be interpreted but could not at time originally taken.
3. Confusion of oil with fresh and brackish water.
4. Thin beds difficult to analyze.
5. Capping of thin lime, coal, or lignite over an oil sand may "blank out" the oil.
6. Calcareous sandstones difficult.
7. "Big kicks" versus "little kicks." Most people look for oil in the big kicks of a log, whereas most of the oil is found in the smaller kicks today.
8. "Dirty" formations containing shale and clay have unusually low resistivities and are easily passed by.
9. Distortion of curves near the total depth of a hole.
10. "Dead zone" in the upper part of a thick bed. Particularly difficult when water lies just under oil at this point.
11. Bed thickness same as that of electrode spacings. The apparent kicks look bad.
12. No information available as to salinity of formation water. (To find oil we must first know the waters.)
13. Excessive mud filtrate invasion in areas of poor muds.
14. Extremely salty muds flatten the details of the curves.
15. Lack of experience with "critical water saturation" values.
16. Oversimplification of the quantitative interpretation methods and charts.

What the Log Reveals

While it is evident that an impressive number of potential discoveries have been plugged for one reason or another, the process of segregating the probable producers from the host of actual dry holes by electric-log analysis is slow and tedious. Results, however, have been most gratifying.

Just how many new field discoveries should be credited to reexamination of electric logs is not known. Whatever the total, the growing use of fracture processes within the past few years has provided the log analyst with an even greater range of probabilities.

Electric log data . . . The conventional electric log which plots continuously from total depth to surface casing provides a variety of information through interpretation of its curves.

Briefly, the shape and magnitude of the potential kicks on the left side are determined by:

1. Thickness of the formations.
2. Salinity of water in the pore space.
3. Shale content of the formation.
4. Porosity and pore structure of the formation.
5. Oil in the pore space.

On the right side, the curve denotes similar factors but with added detail, and more important, the relative amounts of oil and water in the pore space. Per cent porosity and per cent water saturation in the pore space can be measured by the resistivity kicks on the right side of the log.

Increasingly recognized in recent years is the need to determine the water-oil saturation values. Both water and oil are customarily contained in a probable producing formation in varying relationships, with the greatest oil percentage existing in the upper portion of the section. Water content generally increases toward 100 per cent in the lower portion of the section. A true and precisely located water-oil contact, once believed normal, is actually rare.

Need for Careful Water Determination

In evaluating a log showing a probable producing zone it is necessary to determine the water saturation and then to compare this with the critical water-saturation value for that particular formation. If these values are in desired relationship, a reservoir will produce clean oil. If the index is near the critical, production will be water cut, and if the ratio of water is above the critical index, only water with possibly some residual oil will be produced.

The writer is unaware of any mathematical method of calculating these critical values but is aware of a practical method for obtaining them for each formation through hard work and experience by correlating the results of actual testing with water saturations obtained from core analyses and electric logs.

Since resistivity kicks measure the relative per cent of oil and water in the pore space they will be the greatest at the top of the bed and the least near the water table. There is a slope of resistivity from top to bottom. Such resistivity slopes are generally indicators of the presence of some oil in the formation. However, they are related to porosity changes also and it is necessary to correct for this effect.

Supporting Evidence

Although it is possible to analyze the log of a formation without any supporting information from samples, cores, drill-stem tests, and gravity of the oil, it is unrealistic not to utilize such information when it is available. There is a happy medium where the analyst uses all information but is not influenced too greatly by any single portion of the total evidence.

Proper analysis of electric logs is by no means confined to determining routine factors. Properly handled, the electric log is a highly flexible exploratory tool.

Because of the extreme sensitivity of resistivity recordings of oil saturation in shaly and sandy shale sections, logs often point the way to productive traps and pinchouts. Many pools of the trap type have been found in the Pennsylvanian section of the Mid-Continent re-

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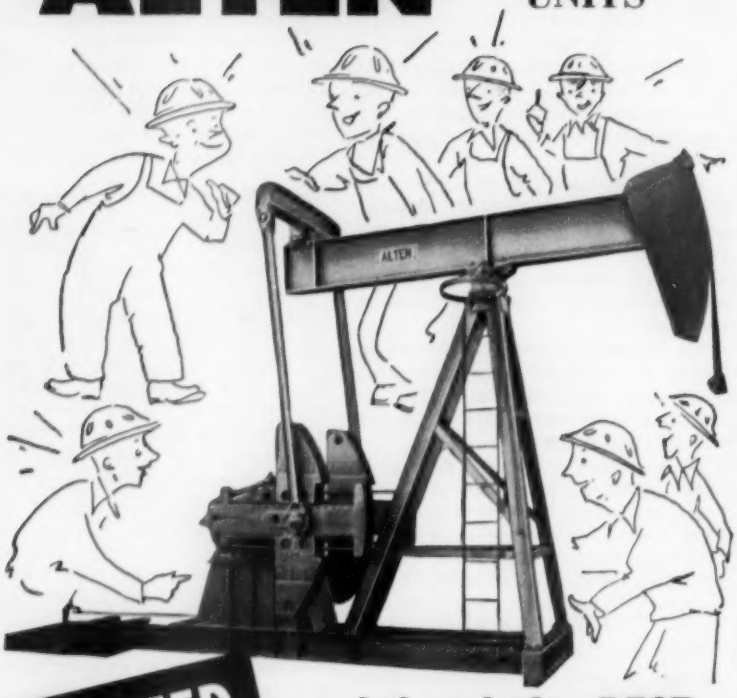

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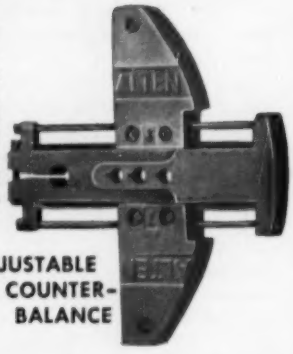

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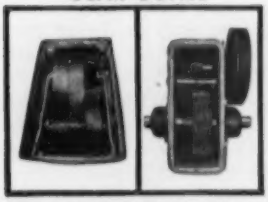

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gion by starting with one or two logs and either working updip or toward a change in reservoir characteristics. In fact, in many instances, a field is more readily discovered by electric-log study than is an isolated producing zone in a plugged well.

Planned Programs

There are a number of methods of applying the procedure. One operator has made an exhaustive study of all electric logs he has filed since running his first about 15 years ago. Result: two new fields.

A large independent has augmented his own log file with copies of all logs obtainable in the area of his activity. Result: four discoveries.

Still another method of such a survey, a procedure that is paying dividends in successes, is to take a single formation and study its curve in every well in a county. The examination may then be extended into an adjacent county, using the information already gained as valuable backlog data, or the analysis may be refocused on another formation, again supported by information already developed. In any case, a planned program is desirable. There is the factor of odds present in finding oil by means of electric logs just as there is the one-to-nine factor in routine exploration.

The finding of new oil by analysis of old logs is a relatively new exploratory method in a fast-changing industry. The procedure is just getting into high gear and has enjoyed a notable success ratio. Present economic conditions have given impetus to the work.

Once found, and brought to the surface, a barrel of new oil loses its identity but not its value. Above all else it represents the three "R's" of the oil industry—Results in terms of Reserves and Recoveries.

NOTE: The second part of Dr. Hamilton's paper, giving specific examples and illustrations of finding oil through electric-log examination, will appear in the December 13 issue of The Oil and Gas Journal.

ILLINOIS

Sangamon County has what appears to be its best oil well at W. F. Wooters & Associates 1 Robinson, NW SE 10-14n-4w, 7 miles southeast of Springfield.

The well had excellent Silurian lime saturation at 1,730-42 ft. The discovery is 5 miles from other good oil production.

A rank wildcat in Saline County, more than 6 miles from production, is Calvert Drilling Co., Inc. 1 Bona Unit, NW SW NW 23-8s-5e.

The Bethel sand at 2,670-80 ft. recovered 122 ft. of clean oil, 85 mud-cut oil. Coring is now underway in the Aux Vases at 2,854 ft.

CANADA

Basal Cretaceous Sand Strike Reported In Brooks Area

Merrill Petroleums, Ltd., and Canadian Export Gas, Ltd., and associates have discovered 25°-gravity oil in a basal Cretaceous sand at a wildcat in the Brooks area of southern Alberta, 90 miles southeast of Calgary. This venture, the 4-19 Brooks, is located on LSD 4, 19-18-15w4, 5 miles northeast of a dry hole.

Gas flowed at the maximum rate of 1,000 M.c.f. per day on drill-stem test at 3,513-51 ft. Pipe recovery was 1,130 ft. of oil.

Dual Pay Discovery Finds Oil In the Granta Area

In the Granta area, 65 miles southeast of Calgary, Socony-Vacuum Oil Co. of Canada, Ltd., has found some oil encouragement in both the basal Blairmore and Madison formations.

The Socony-CPR 14-11 Granta, LSD 11, 14-22-19w4, tested in the basal Blairmore from 4,081-4,116 ft. The Madison was entered at 4,190 ft. Drilling continues.

Southeast Part Of Saskatchewan Gets Strike

Imperial Oil, Ltd., has a possible oil discovery in the southeastern sector of Saskatchewan at 9-26 Nottingham, LSD 9, 26-4-32w1, 20 miles northeast of Pierson field and 60 miles northeast of Estevan.

It is learned that a drill-stem test in the Mission Canyon at about 3,535 ft. gave up a pipe recovery of 240 ft. of crude oil.

Leslieville Area Wildcat May Develop As Cardium Hit

Indications are that Imperial's wildcat in the Leslieville area of central-west Alberta Province will develop into a Cardium sand oil producer. The I-33 Leslieville, LSD 1, 33-39-5w5, 35 miles northwest of Red Deer, recovered about 30 bbl. of oil per day through restricted choke.

EASTERN CANADA

Quebec . . . In Quebec Province, Eastern Canada Gas and Oil, in a wildcat test drilled by George H. Rawlings in St. Jean County, near the city of the same name, got a measured gas flow of about 200,000 cu. ft. at 4,750 ft. depth. This is the first deep test drilled in the area, and production was secured in a formation, tentatively identified as the Chazy, and below the Trenton limestone. A second test for Eastern Canada Gas and Oil, drilling southeast of St. Valentine and 15 miles south of St. Jean, is below 400 ft. The area is on the Richlieu River, south of the St. Lawrence and some 24 miles south of Montreal.

North of the St. Lawrence, Imperial Oil, which has secured extensive drilling rights from the provincial government, is carrying an exhaustive gravimeter survey of areas on the north shore near Trois-Rivieres.

Ontario . . . In Huron County, natural gas in fair commercial quantities has been encountered in three wells drilled by Imperial Oil near the village of Zurich, two of the wells being on the Egbert Heidman farm. The production is the first discovered in the county, where drilling for oil in 1866 at Saltford, opposite Goderich, led to the opening of extensive salt deposits. In the past year several companies have ben active in oil and gas development in various parts of Huron. New Gas, Ltd. of Sarnia, represented by Francis Shaw, is negotiating with Zurich and other municipalities for gas franchises. Production figures have not been disclosed.

APPALACHIAN AREA

OHIO

A step-out of 1 mile south of Brinkhaven pool in Union Township, Knox County, is rated at 200 bbl. initial in a 24-hour test after fracturing. On 1 Stanley Banbury, Lot 12, Clinton sand was logged at 2,768-2,801 ft. with an oil and gas showing natural.

The north part of New Castle pool was extended ¼-mile east by Preston Oil Co. 1 Heffelfinger, 2nd. Qr., New Castle Township, Coshocton County. Clinton at 3,204-50 ft. produced 290 bbl. in a 24-hour test after fracturing.

The first offset to the Stone well in Washington Township, Hocking County, made 75 bbl. in a 24-hour test 6 days after fracturing. Bell et al 2 Stone, Section 34, found the Clinton at 2,731-88 ft.

WEST VIRGINIA

In Plymouth district, Mercer County, West Virginia, United Fuel Gas Co. 8180 J. B. Eads, rank wildcat, elevation 1,764 ft., was dry but recorded shows of gas in the Maxon sand, Big lime and Weir sand, completing through this last formation at a TD of 3,504

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ft. Glade district, Webster County, Nelson W. Taylor, agent for R. M. Brewster et al 1 Bonnie Jean Woods, elevation 2,277 ft., gaged 3,186,000 cu. ft. gas, Maxon sand 1,455 ft., gas 1,455-1,505 ft., TD 1,505 ft. This immediate area has ceased to be wildcat and developed into what can now be called town lot drilling.

OKLAHOMA

Madill Anticline Area Reports Two New Wildcats

The Madill area in Marshall County, scene of Sinclair Oil Co.'s 1 Griffin multipay indicated discovery, has two new wildcat locations staked.

The 1 Little, SW NW SE 15-5s-5e, is slated for 6,900 ft. Sun Oil Co. will drill a wildcat 1 mile west of the 1 Griffin in SE NE NE 17-5s-5e.

The 1 Griffin is currently drilling below 7,246 ft., aiming for the 7,450 ft. mark. Sinclair et al have found gas pay in the Sycamore and Viola, wet gas from second and third Bromide sands, oil in the shallow Springer sand and in upper Bromide and upper and lower basal McLish. Drilling is now in the Oil Creek.

Basal Oil Creek Sand Cored At Marshall Wildcat

Sinclair Oil & Gas Co. et al have cored the basal Oil Creek sand at their highly significant Marshall County wildcat in southern Oklahoma.

The 1 Griffin, located in SE NE NE 16-5s-5e. north of Madill, topped the zone at 7,442 ft. A core taken at 7,451-65 ft. for 10½ ft. of soft, porous sand with stain and odor was reported. The operators reported recovery of 28 ft. of saturated sand on core at 7,465-93 ft. This zone is promising to be commercial, adding another pay to the long list already tested.

Hart Sand Producer Reported West Of Lindsay

Cities Service Oil Co. 1 McCoy, C NE NE 17-4n-4w, has extended Garvin County production in the area west of Lindsay.

The discovery flowed 147 bbl. of oil in 6 hours through 14/64-in. choke natural from perforations at 8,148-62 and 8,248-62 ft. in the upper and lower Hart sand. The wildcat is located just 1 mile east of West Lindsay-Hart field and the same distance north of Erin Springs field Hart-Springer production. The Springer did not prove productive at the 1 McCoy discovery.

Bradley Report

Good flowing wells are reported in Grady County's Bradley Townsite area. Phillips Petroleum Co. 1 Sterr, NE SW 25-5n-5w, flowed 465 bbl. of oil in 16 hours through perforations in upper Bromide sand at 12,096-12,266 and 12,293-12,351 ft.

Phillips 1 Theodosia, SW SW 36-5n-5w, flowed 405 bbl. of oil in 16 hours through 16/64-in. choke from two upper sands of Ordovician age at 12,398-13,650 ft., while the lower three zones got 83 bbl. in 24 hours on ¼-in. choke.

Garvin County Bromide Discovery Completed

Stanolind Oil & Gas Co. has completed a good discovery in Garvin County. The 1 Pitchlynn, 14-4n-2w, flowed 400 bbl. of 40°-gravity oil in 9 hours through perforations at 5,936-44 ft. and 5,972-78 ft. Production is from Bromide sand.

CALIFORNIA

New Sunset Beach Find Indicated

Formation tests at Hancock Oil Co.'s wildcat 1½ miles northwest of Burt Aston's recent discovery at Sunset Beach, Orange County, indicate the well probably will result in a new field discovery. On a 1-hour test at 7,628-7,788 ft. about 2,000 ft. of 29°-gravity oil was recovered. Following the test Hancock continued to drill ahead toward the scheduled depth of 9,000 ft.

Designated 1 Alamitos Land, the wildcat is located in 13-5s-12w. In SE NE 19-5s-11w, Aston 2 Lomita last June was completed in a 7,100-ft. sand for a 500 bbl. producer. In mid-November Atlantic Oil Co. completed 1 Ramser in NW NW Section 29, about ¾ mile southeast.

Wheeler Ridge Test Redrilling

Richfield Oil Corp. plugged back its wildcat 1½ miles southwest of the Wheeler Ridge field, Kern County, and was redrilling below 8,500 ft. In drilling to 11,938 ft., total depth, Richfield 2 San Emidio-B found potential Eocene sand production at approximately 11,225 ft. In order to give the sand a thorough test pipe was set at 8,487 ft. Hole later was plugged back to 8,460 ft. Site of the wildcat is in NE SW 21-11n-20w.

Tejon-Grapevine Extended

The ¼-mile south stepout of Lake Oil Co. at Tejon-Grapevine, Kern County, indicated it would extend the new Olcese pool. The sand was topped at 5,695. At 5,813 ft. the bit was still in oil sand, according to field reports. Location of 1 Crane is in SW NW 34-11n-19w.

KANSAS

Graham County Reports Promising New Discovery

Imperial Drilling Co. has a successful wildcat indicated at 1 Hoof, NE NE SW 9-10s-23w, 1½ mile north of Happy field.

The operator has taken nine successful drill-stem tests in the Lansing. The wildcat flowed oil at the estimated rate of 43 bbl. per hour on drill-stem test at 3,860-71 ft. Two offsets have been staked near the discovery.

Rush County Wildcat Recovers Lansing Oil

A drill-stem test in the Lansing at 4,178-4,223 ft. recovered 3,700 ft. of oil at Natural Gas & Oil Corp. and Republic Natural Gas Co. 1 Webb "C," NE NE NE 16-19s-20w, Rush County. The wildcat is 6½ miles northwest of Pawnee County's Shiley field.

HUGOTON EMBAYMENT

Texas County's Camrick Field Extended Southeast

Carter Oil Co. 1 Littau-Flowers Unit, SW SW NE 25-1n-19eCM, has been finaled, extending Morrow sand oil production 1 mile southeast of Camrick field in Texas County, Oklahoma Panhandle.

The well potentialed for 158 bbl. per day on swab perforations at 6,363-78 ft. in the Morrow sand.

Clark County, Kansas Morrow Discovery Is Shut In

Shamrock Oil & Gas Corp. 1 Stephens "H," SE SE 10-32s-21w, 3 miles southeast of Lexington field and 2 miles northeast of abandoned Morrison field in Clark County,

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is shut in after making a flow of 9 bbl. of oil in 1 hour and 45 minutes on ½-in. choke from the Morrow.

The discovery also got 3,996 M.c.f. of gas per day. Perforations were at 5,202-07 ft. Gage on the zone at 5,189-5,202 ft. was 2 bbl. of oil in 2¼ hours on ¼-in. choke, plus 1,625 M.c.f. of gas per day.

The new producing area is 10 miles north of prolific Harpers Ranch and 8 miles north of a recent discovery at Sinclair 1 Combrink, Morrow gas discovery of North Harpers Ranch field.

Arbuckle Discovery Finaled In Scott County, Kansas

Western Kansas has officially opened its first Arbuckle production at a Scott County wildcat, more than 80 miles west of nearest previous production from the Cambro-Ordovician formation.

W. L. Hartman 1 Rush, NW NW NE 10-19s-31w, 4 miles south of Grigsby and 4½ miles southeast of Keystone-Lansing field, pumped 153 bbl. of oil daily from perforations at 5,050-54 ft. The field has officially been designated at Griggston field.

MICHIGAN

Best Traverse Hit of Year Testing In Newaygo

Initial tests after 5-in. casing was run and cemented were encouraging at the James J. McGerry, Trustee 1 Cook, NE NE NW 7-11n-11w, Ensley Township Traverse oil-showing wildcat, Newaygo County.

Wildcat, bottomed out in Traverse at 2,441 ft., filled 1,500 ft. with free oil on an overnight test following clean-out below 5-in. casing seat. Top of Traverse lime was logged at 2,431 ft. This wildcat is being heralded as Michigan's newest, and best-looking Traverse discovery for the year. Tubing was run. Well produced some oil while tubing was being set and next day, additional oil was swabbed from the well. No official gages were announced. Well will probably be acidized.

First Richfield oil pay for Akron field, Tuscola County, in the Michigan "Thumb" area, was showing up very satisfactorily on tests and while deepening through the estimated additional 100 ft. of Richfield section were in progress. Well has been producing, flow and swab, from 30 to 44 bbl. of oil daily. Initial tests were run at 3,779 ft. at this Richfield discovery producer, the Byron A. Bartlett 1 Elek, NE SW SE 23-14n-7e, Wisener Township. In 5 days, on test at this point, well swabbed and flowed 196 bbl. of oil natural. This is the fourth Richfield oil test in the Akron field area; first to show an oil pay.

Deepened from the "sour zone" to the Richfield, acidized and dually completed in both of these oil pays, the J. E. Bauer 1 Wood, SW NE NW 22-19n-4e, Deep River Township, Arenac County, was completed good for as much as 276 bbl. of oil, flowing, in 8 hours. This deepening, which has resulted in the completion of the best "sour zone" and Richfield oil well in the prolific Deep River Dundee field area, was started recently after well had originally been completed in the "sour zone" with 5-in. casing in hole. Well was flowing natural from the "sour zone" at a restricted rate of 55 bbl. when tools were rigged up to drill ahead. The 1 Wood was bottomed out in Richfield at 4,194 ft. Richfield pay at 4,152-57 ft. was acidized with 3,500 gal. and well flowed 176 bbl. of net oil in 24 hours. "Sour zone" pay was perforated and acidized with 2,500 gal. at 3,921-47 ft.

NEW MEXICO

SOUTHEAST NEW MEXICO

Devonian Prospect South Of Cross Roads Field

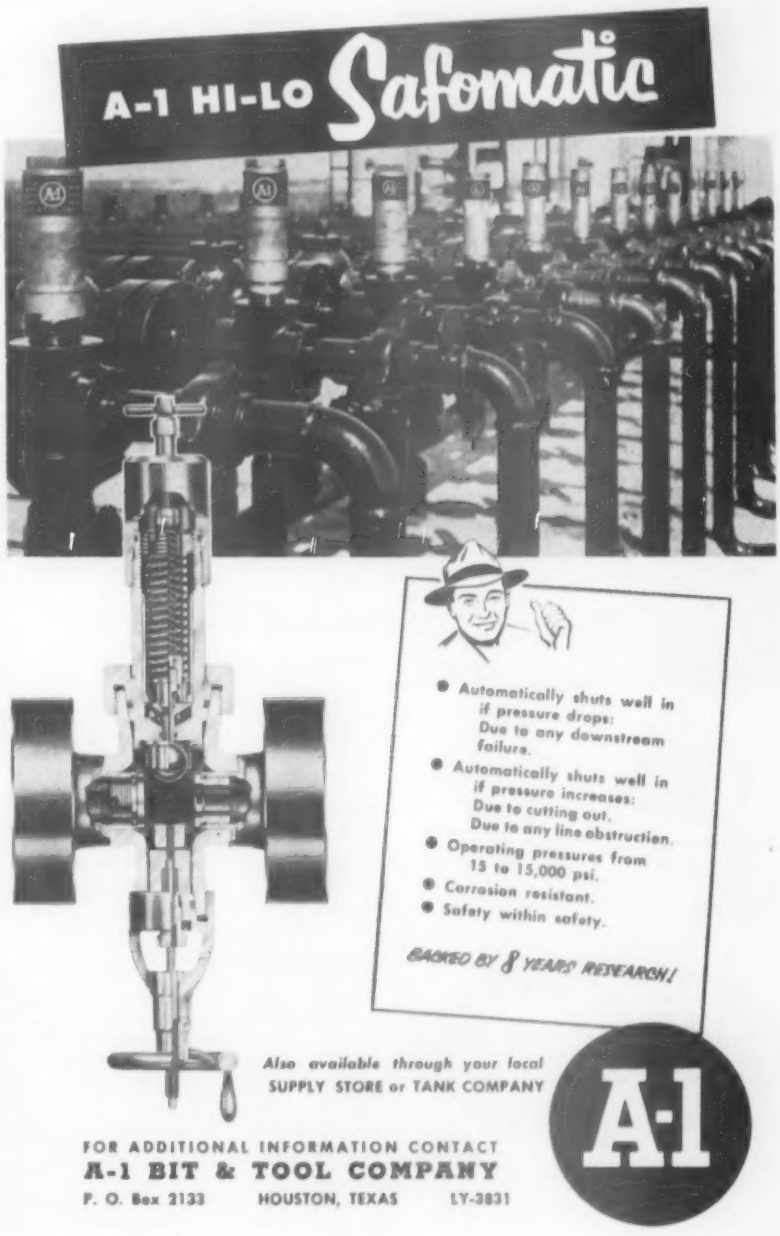
Texas Pacific Coal & Oil Co. 1 South Cross Roads Unit, 2½ miles south of production in NE SW 10-10s-36e, northeastern Lea County, is showing for a Devonian discovery. Operators ran casing to bottom at 12,420 ft. after developing free oil on drill-stem tests of the Devonian between 12,250-12,330 ft.

Treatments of regular and mud acid were made through perforations at 12,254-92 ft., after which the well swabbed 106 bbl. of load oil in 4 hours then kicked off and flowed 66 bbl. of fluid in 3 hours through ¾-in. choke. On 20/64-in. choke, the well flowed 42 bbl. of new oil in 2 hours. Flowing pressure on tubing was 100 psi. Sample top on the Devonian was 12,250 ft. on elevation of 4,024 ft.

KENTUCKY

EASTERN KENTUCKY

In Breathitt County, United Fuel Gas Co. wildcat 8281 Kathryn Arnett et al is bottomed at 2,739 ft. after penetrating Clinton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sand from 2,696 to 2,727 ft. with no shows. However, Corniferous lime topped at 2,069 ft. carried gas showings from 2,186 to 2,205 and 2,247-50 ft. Operators are shooting and testing.

LOUISIANA

NORTH LOUISIANA

Gas-Condensate Flowing At Tensas Parish Wildcat

Tensas Parish in east-central Louisiana has a new condensate hit at H. L. Rowley I Adams, C NE SE 20-10n-11e, near the town of Locust Ridge.

The lower Tuscaloosa discovery is flowing on 1-hour test at the rate of 52 bbl. of condensate and 2,000 M.c.f. of gas per day on ¼-in. choke.

Washington Unit Discovery Completed In Claiborne

Stanolind Oil & Gas Co. et al 1 Washington Unit, a Claiborne Parish wildcat, has been completed in 22-22n-5w.

The discovery well flowed 119 bbl. of 52°-gravity oil in 10 hours through perforations at 10,320 to 10,456 ft. Production is from the Smackover lime.

SOUTH LOUISIANA

New Gas-Condensate Area Opened By Vinton Wildcat

A new gas-condensate field, located 5 miles east of Vinton, in Calcasieu Parish, is being opened by W. T. Burton, of Sulphur, La. His discovery well, 1 Lawton, in 27-10s-11w, is rated good for 45 bbl. of 49°-gravity condensate with 829,870 cu. ft. of gas per day, flowing through 6/64-in. choke with pressure of 5,750 psi. Production is from sand interval at 9,383-93 ft. Vinton field, just south of Vinton townsite, is nearest production of any kind.

Big Lake Extension Well Gets Oil In Deep Gas Pay

Production in the Big Lake area of Cameron Parish is being jumped 2 miles to the northwest by a 13,600-ft. oil well completed by Stanolind Oil & Gas Co. The well, 1 Gardner estate, is producing oil from that sand, which, up-dip in the field, at approximately 13,000 ft., yields gas and condensate. Flow through 10/64-in. choke was at the rate of 552 bbl. of 31.7°-gravity oil per day. Casing-perforated interval is 13,586-13,600 ft. in hole drilled to 13,980 ft.

Venice Deep Exploration Uncovers New Pay Sand

Venice field, in the Mississippi River delta, Plaquemines Parish, added another deep productive sand with completion by Tide Water Associated Oil Co. of its 2-E Manhatten.

The new-pay producer, located on the northwest side of the field, flowed at the rate of 264 bbl. of 37°-gravity oil per day through 11/64-in. choke during a 2-hour potential gage. Flow was with gas-oil ratio of 1,352 cu. ft. per barrel under 1,300-psi. pressure.

Pay zone is producing from casing-perforated intervals at 13,714-22 ft. and 13,742-60 ft. Oil production previously had been tested from perforations at 13,795-13,805 ft. and 13,817-23 ft. Two deeper oil-showing zones, one at 14,260-87 ft. and the other at 14,377-83 ft., were not tested.

The well was started with a depth objective of 17,000 ft. but operators elected to quit drilling at 15,857 ft. to complete in the zones already encountered.

Extension Discovery At Chacahoula Confirmed

Discovery last September by Howell, Holloway & Howell of a new deep producing reservoir 1½ miles northeast of previous production, on the north flank of Chacahoula dome, in Lafourche Parish, is confirmed with the reservoir's second well, being completed by the same operators.

The new well, 2 Energy, ¾ mile northeast of the initial extension well (1 Energy), produced at the rate of 14.40 bbl. of 46.1°-gravity oil with 800,000 cu. ft. of gas per day on pre-potential tests through chokes. Pressure gaged 4,400 psi. Pay interval is 12,628-36 ft.

TEXAS

TEXAS GULF COAST

DeWitt County Wildcat Tests Gas-Distillate Pay

Testing is under way at an indicated gas-condensate discovery well 5 miles west of Thomaston, in DeWitt County. The well, 1 Koenig, drilled by Kirkwood & Co., is perforated in an 8,700-ft. Wilcox sand, from which 1,150 ft. of heavily gas and distillate-cut mud and some free distillate was recovered in an open-hole drill-stem test. This test, open 15 minutes through ¼-in. chokes, took in an interval at 8,745-76 ft. Since then, hole has been drilled to 9,015 ft., and has casing run to bottom. Location is 2 miles north of Arneckeville field.

Frio Sand Production Extended At Danbury

New deep Frio production on the southeast flank of Danbury dome, in Brazoria County, has been extended 1,300 ft. northeastward around the dome.

Extension is by Stanolind Oil & Gas Co. and Humble Oil & Refining Co. at their 1 Kopplin, in the L. L. Tomlinson Survey, completed in pay interval at 8,381-92 ft. after being plugged back to 8,413 ft. from total depth of 9,150 ft. Top of the pay was logged at 8,376 ft. with surface elevation of 25 ft.

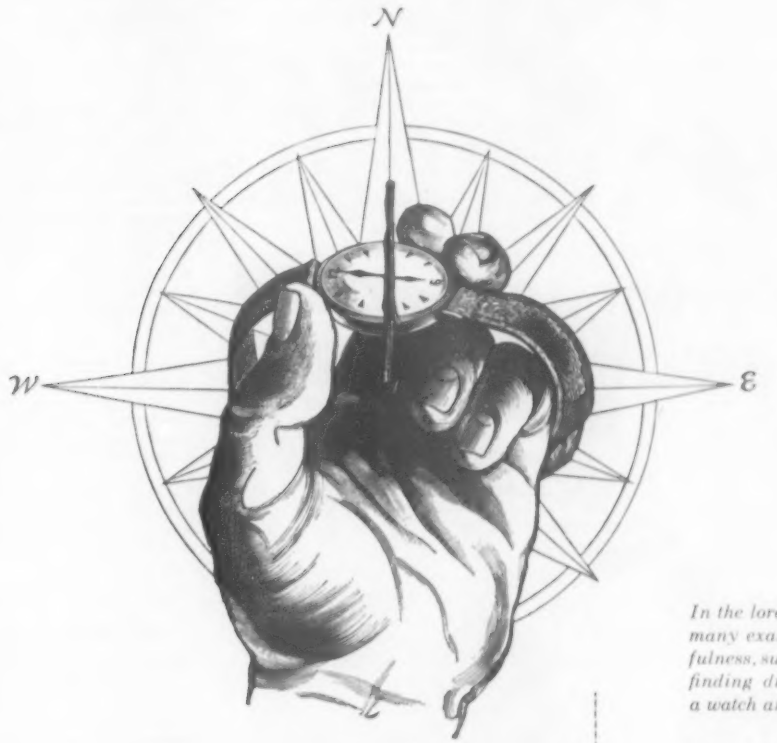
Completion was with a flow rate of 206 bbl. of 37°-gravity oil per day through 5/32-in. choke. Pressure was 1,000 psi. and gas-oil ratio 646 cu. ft. per barrel.

Martha Area Revived By New Pay Zone Discovery

The first well drilled in the Martha area, of Liberty County, since 1941, is being completed as a new-pay discovery for the field. It is Gulf Coast Leaseholds, Inc., 1 Seaberg, located on the north side of the field.

New pay is in Yegua sand with production from two zones, one at 8,116-39 ft., and the other slightly deeper at 8,162-89 ft. Initial completion is in the upper zone to be produced through the casing. Flow from this

RESOURCEFUL



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zone was at the rate of 93 bbl. of 38.3°-gravity oil per day through ¼-in. choke with pressure of 100 psi. and gas-oil ratio of 300 cu. ft.

Completion in the lower zone, to be produced through tubing, is waiting installation of pumping equipment. Oil production was indicated in initial tests (no gage).

Production at Martha was discovered by Stanolind Oil & Gas Co. in 1939.

WEST TEXAS

Ector and Midland County Discoveries Assured

Midland County gained another Ellenburger strike as Gulf Oil Corp. made a good well at its 1-L Scharbauer, north of Midland, and a completion gage was turned in at The Texas Co. 1 Ratliff, Ellenburger discovery northwest of Headlee field.

Following perforations at 12,720-90 ft. and washing with 500 gal. of mud acid, Gulf 1-L Scharbauer kicked off and flowed 253 bbl. of new oil and 52 bbl. of load oil in 11 hours. The flow was through ¾-in. choke, with gas-oil ratio at 540:1. This well has made extensive tests throughout the Ellenburger, with lesser results from other sections. Prior to the flow, perforations at 12,850-12,915 ft. developed salt water with no oil on drill-stem test.

Operators plan to complete the 1-L Scharbauer as a dual discovery. Perforations in the Waddell sand, or middle Simpson, at 12,584-12,625 ft. produced 251 bbl. of new oil in 24 hours by swabbing and flowing.

Gulf's project also flowed gas and recovered distillate on drill-stem tests in the Pennsylvanian.

Nearest Ellenburger wells on production are in Headlee field, but nearest Ellenburger oil is The Texas Co. 1 Ratliff, Ector County discovery north of Odessa which flowed 508 bbl. of 54.5°-oil through 48/64-in. in choke on a 21-hour potential test. Gas-oil ratio was 1,150:1.

Second Ellenburger test high . . . Southland Royalty Co. 1 Roy Parks, east offset to British-American 1 Parks, discovery in the Dora Roberts trend in Midland County, was reported running high on the Ellenburger.

Tentative top on the Ellenburger at Southland's test, by samples, was 12,903 ft. A drill-stem test at 12,900-13,020 ft. flowed 70 bbl. of oil in 1 hour through ⅝-in. bottom-hole choke, after cleaning into pits, then gaged 110 bbl. of oil on a 1-hour test at 13,046-13,170 ft.

New pay at Big Lake . . . Pennsylvanian pay has been added to this field, which produces from the Permian, Fusselman and Ellenburger formations. Big Lake Oil Co. 1 University, on the west side of the field, Section 2, Block 2, flowed 9 bbl. of oil in 45 minutes on drill-stem test at 8,338-8,403 ft. Gas volume was at the rate of 957,000 cu. ft. per day.

New pay at Texel . . . Gulf Oil Corp. 3-H McElroy, second well for Texel field and southeast offset to the field's Ellenburger and Devonian dual discovery, completed from the Pennsylvanian and Devonian.

Potential from the Pennsylvanian at 9,143-95 ft. was 261 bbl. of 45.6° oil a day through 12/64-in. choke, with gas-oil ratio of 1,531:1. Potential from the Devonian at 11,220-95 ft. was 81 bbl. of 45.7° oil, with gas-oil ratio of 1,719:1.

NORTH TEXAS

Deepening Planned for Grayson County Test

Star Oil Co. will redrill a Pennsylvanian failure 3 miles northeast of Van Alstyne in southern Grayson County, carrying the new hole to 13,000 ft. from old total depth of 7,814 ft. The new venture will be 1 E. B. Whisenant and is located in the W. S. Thompson Survey, A-1207.

Humble Oil & Refining Co. 1 Davis, wildcat prospect 10 miles northwest of the above well, developed 7,000 ft. of free oil on a drill-stem test in the Pennsylvanian at 8,080-8,164 ft., then swabbed 25 bbl. of oil in 11 hours through perforations at 9,400-40 ft.

SOUTHWEST TEXAS

Saspamco Extension Area Gets Large Oil Producer

What is indicated to be the best well so far in the new extension area west of Saspamco field, in southeastern Bexar County, 15 miles southeast of San Antonio, is being completed by Hillsman & Greenburg at their 2 Stoddard.

Testing acidized Austin chalk section in open hole at 2,369-2,910 ft., the well flowed at an estimated rate of 600 bbl. of oil per day. It is only 660 ft. north of a dry hole, the same operators' 1 Stoddard.

New Pettus Oil Discovery Indicated In La Juna Area

Another Pettus sand discovery, either a new pool or a mile extension of the recently opened La Juna field, in northeastern Duval County, is indicated by showings encountered by Bridwell Oil Co. in its 3-B Canales.

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Bridwell's wildcat test, located south of the La Juna discovery well, completed in October by J. S. Walker and A. W. Gregg Drilling Co., filled 140 ft. of oil in 20 minutes through ¼-in. chokes in a drill-stem test at 4,625-30 ft. in Pettus sand. No water was recovered. Bottom-hole pressure was 275 psi. flowing and 1,250 psi. shut in.

Gregg's discovery well, so far the only well completed, produces from Pettus sand at 4,715-24 ft.

Location of the area is approximately 12 miles northwest of San Diego, near the Jim Wells County line.

ROCKY MOUNTAIN

MONTANA

Flow Gage Reported At East Baker Discovery

Monoco Oil Co. of Billings has reported results of test of 1 Ferguson-Goldin, C N½ SE SW 18-7n-61e, in the East Baker area of Fallon County. The well flowed at the rate of 495 bbl. of oil per day on 5-hour test. Production is from perforations in Red River (Ordovician) at 9,246-84 ft. Discovery was reported some time ago, but the operator released only results of one drill-stem test which had recovery of nearly 9,000 ft. of oil in 4 hours.

The discovery is 7 miles east of the town of Baker and east of the Cedar Creek anticline, where a majority of Williston basin production in Montana is located.

Monoco has made location for two additional wells in the area, and McAlester Fuel Co. has begun drilling on a southeast offset to the discovery. Production is believed to be from stratigraphic trap, which shares with location in the importance of the wildcat. There is no other stratigraphic production in the central area of the Williston basin.

Carbon County Deep Test Located

Phillips Petroleum Co. has made location for a 10,000-ft. test to Madison in Carbon County. The well is 1-A Louma, in the Luther-Fox area of the county. It is 6 miles northwest of Dry Creek. The area has had no previous drilling.

Phillips County Madison Test Fails

Continental Oil Co. has abandoned 1 Landon, SW SW 1-30n-46e, in the Wolf Creek area of Phillips County. The well went to a total depth of 6,560 ft., with Mission Canyon top found at 6,220 ft. No tests were run, and light staining in fractures in Mission Canyon was the only show reported. The well is 2 miles northeast of the Wolf Creek discovery drilled a year ago by Continental, and now shut in.

Confirmation Attempt At Brorson Announced

Sun Oil Co. and Phillips Petroleum Co. have made location for a third well in the Brorson area of Richland County. The well is 1 Dennis Dynneson, SW SE 30-24n-50e. It is 1 mile northwest of the Ordovician discovery drilled by these operators in 1953, and ½ mile west of the second Brorson well which found production in Madison and did not test deeper zones. Thus the new well,

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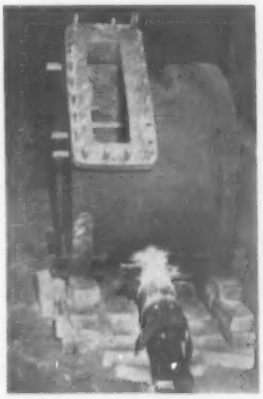

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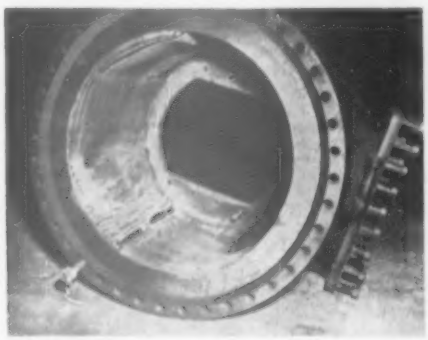

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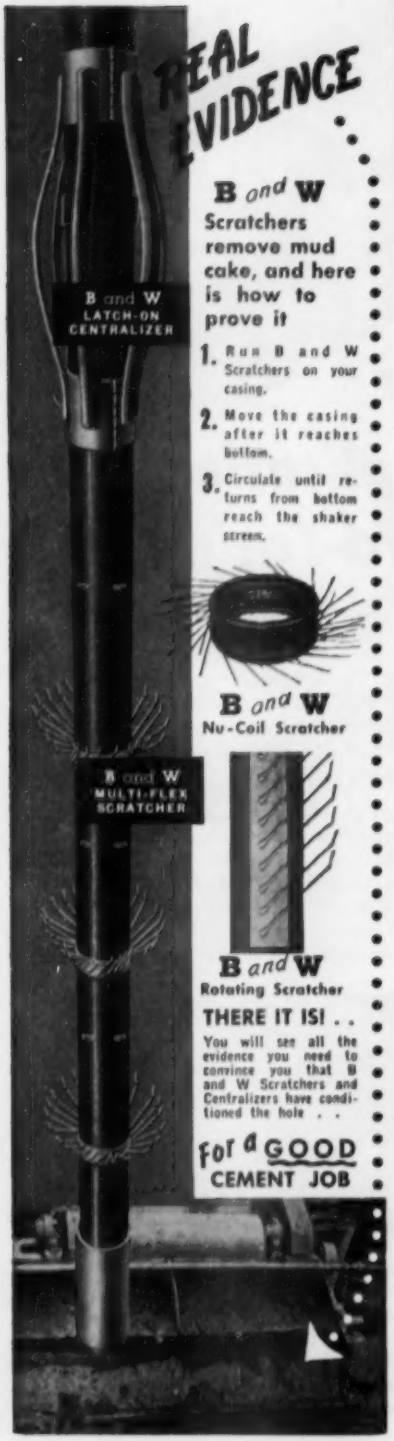
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scheduled to go to Ordovician is a potential confirmation to production in both formations. The Brorson discovery had shows in Madison, but was completed in Ordovician. The second well in the area was the first to find commercial shows in the upper zone.

UTAH

Desert Springs Discovery Testing

Shell Oil Co. has completed tank construction and is testing at 2 Desert Creek, SE SE 35-41s-23e in the Desert Creek area, San Juan County. The well flowed 256 bbl. of fluid, cut 8 per cent with sediment and water in 24 hours. Tubing pressure was 350 psi. The test was of perforations in Paradox (Pennsylvanian) at 5,244-72, 5,294-5,306 and 5,316-20 ft. On initial testing some time ago the wildcat flowed at a rate in excess of 1,100 bbl. of oil per day. The current test was on 14/64-in. choke. Shell is continuing to test.

The well is the first apparent success in the southeastern Utah area. Previous drilling in this portion of the state has found good Pennsylvanian shows in some cases, but tests went heavily to water.

Second Productive Zone Found At Blueball

Carter Oil Co. has tested a second apparently productive zone at 2 Unit, C SW NW 3-1s-2w, in the Bluebell Unit, Duchesne County. Four-hour test at 9,470-9,505 ft. recovered 2,340 ft. of oil with a 1,380-ft. water cushion. Flowing pressure was 650-1,400 psi. Oil is 19.5°-gravity.

The zone is the second in this well to show for production. Early in November a test at 9,009-9,105 ft. recovered 2,790 feet of 25°-gravity black oil and 450 ft. of heavily oil-cut drilling fluid. Tests between these two intervals recovered salt water. Carter is shut down for orders at the wildcat, at total depth of 9,505 ft.

COLORADO

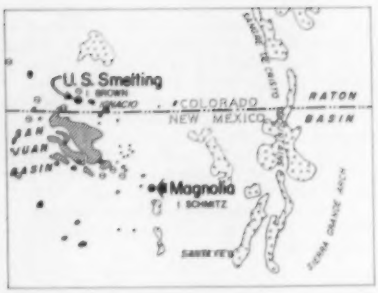
Sinclair Finds Elbert County Production

Sinclair Oil & Gas Co. is preparing to run pipe at a rank wildcat 30 miles southwest of production in Elbert County. The company recovered 920 ft. of 33°-gravity oil on 1-hour test of J sand at 7,167-7,202 ft. at 1 Bradbury, NE NE NE 28-6s-61w. There is now no production in the county. Only scattered exploration has been conducted through this portion of the Denver-Julesburg basin, although landholdings have increased steadily with southward progress of production in the basin.

The Sinclair wildcat is directly in line with the trend of production through the basin, and 30 miles southwest of Badger Creek.

Flowing pressure on the successful test was 40-420 psi. Shut in pressure was 1,650 psi. Total depth is 7,333 ft. Top of J sand was found at 7,165 ft. and core 7,166-7,200 ft. included 15½ ft. of sand with spotty to good stain, odor and fluorescence, and poor to good porosity and permeability.

Production in the Denver-Julesburg basin prior to the modern development of the area was confined largely to the western flank. Since discovery of oil in Nebraska in 1949 the course of new production has been established in a southwest trend through Colorado. The current discovery is the most recent and one of the most substantial extensions of this trend. Sinclair's discovery follows relatively less exploration in a rank



The Southern Rocky Mountains are picking up exploratory speed with the Paradox, San Juan, and Raton basins enjoying busy times. Two important discoveries were completed in the last part of November, one in Colorado, the other in New Mexico. U. S. Smelting, Refining & Mining Co. 1 Brown, in the Bondad area of LaPlata County, Colorado, was completed for 40,000 M.c.f. of gas per day from Dakota. It is 3 miles west of Ignacio in a little-explored area. In New Mexico Magnolia Petroleum Co. 1 Schmitz, Rio Arriba County, finaled for 2,415 M.c.f. of gas per day from the Torreon formation. This gas strike is southeast of Lindrith in an area of no previous gas production.

area than has been the case with many of the better fields in the basin, and demonstrates the possibilities of further work through the area if characteristics of other areas of the basin continue to apply.

Colorado Discoveries Reported In Active Areas

Three wildcats in active areas of the Denver-Julesburg basin have been reported as apparent discoveries, and unconfirmed rumors indicate a possible discovery at a fourth.

In Washington County, New Drilling Co. has run casing and is preparing to test at 1 McFarland, C NE NE 4-3s-56w. The operator reported only that two apparently productive zones were found in J sand and has released no details. Unofficial reports of a drill-stem test at 5,086-92 ft. showed recovery of 310 ft. of oil, 240 ft. of oil-cut water and 30 ft. of oil-cut mud in 1 hour.

Also in Washington County, Petroleum, Inc. recovered 950 ft. of oil and gas, 120 ft. of oil-cut mud and 60 ft. of oil in 1 hour test at 1 Larsen, C NE NW 19-1s-55w. This recovery was from the interval 4,916-27 ft. with top of D sand found at 4,915 ft. The operator will core J sand before attempting completion.

In Morgan County, Skelly Oil Co. reported an apparent discovery at 3 Peterson, SW SW NW 13-1n-56w. A flow of oil at the estimated rate of 2 bbl. per hour was reported from the interval 5,017-31 ft. Tool was open 4 hours. The operator was last reported testing a J sand zone.

The rumored discovery is the Kimbark Co.-Sterling Drilling Co. 1 Porter, C SW SW 30-2s-55w, in Washington County. No confirmation of rumors of shows in this well is available.

WYOMING

Casing Set At Two Widely Separated Wildcats

Two widely separated wildcats in Wyoming have set casing without reporting shows which would justify pipe.

Gulf Oil Corp. ran casing at 1 UP Unit, SE NE NE 11-24n-85w, in the East O'Brien Springs area of Carbon County. Total depth is 6,959 ft. and casing was landed at 6,350

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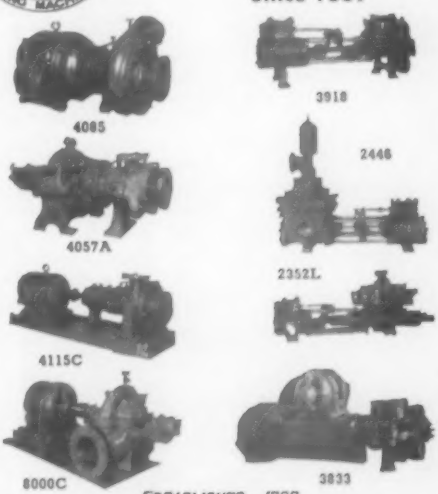

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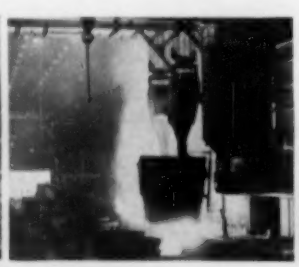
What's the next step? Talk to your Leschen distributor or Leschen field man. They're well qualified to answer your specific questions about Red-Strand steel core wire rope—or to help solve other wire rope problems.



Severe stress, pressure and crushing occur on rotary drilling drums, winches, shovels, draglines, logging lines, and others. Where tons of molten steel are to be lifted by wire rope, great strength and resistance to intense heat are required. Here Hercules Flattened Strand wire rope with wire rope core delivers much-longer-than-expected service.

Hercules Red-Strand wire rope made by
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The Watson-Stillman Company
(A SUBSIDIARY OF H. K. PORTER COMPANY INC.)
St. Louis 12, Missouri

ft. The operator has released no tops or other data.

In Niobrara County, 15 miles south of present production in the Clareton trend, operators have set pipe in 1 Bible, C SE SE 17-37n-67w. Total depth is 9,616 ft. in Dakota. Cores reported by the operator have had no mentioned shows. The well is being drilled by Mar-Tex Oil & Gas Co.

Teton County Wildcat Plugged Back For Test

Placid Oil Co. has plugged back to 9,500 ft. at 1 Govt., SW SE SE 11-42n-112w, in the Sohare Creek area of Teton County, and will test Nugget sand. Total depth is 10,017 ft. Shows have not been reported in the wildcat, which is 29 miles northeast of the town of Jackson.

INDIANA

In new Wheatonville pool, 14 miles north of Evansville, good development is reported. The field's pay is the O'Hara lime at 2,000 ft. The field is located in Gibson and Warrick counties.

ARKANSAS

Rank Hempstead County Wildcat Reports Showing

A slight gas showing was reported at a very remote wildcat in dry Hempstead County, 2 miles north of Washington. H. J. Heartwell is drilling ahead at 2,000 ft. at the 1 Bessie C. Thomas et al, C SE SE NW 9-11s-25w, 2¾ miles southeast of Ozan, after drilling time indicated about 10 ft. of sand at 720-30 ft. with fluorescence and stain reported in samples. The sand is believed to be the upper part of the Bingen sand. A slight gas show was encountered from cuttings at 820 ft.

WILDCAT COMPLETIONS

SOUTHWEST TEXAS
District 1

Atascosa County: Thomas Brothers et al 2 Smith, Edward Estes Sur. 1188, A-222. Dry. TD 1,455 ft.

Yount-Wade, Inc., 1 Miers, Henry Hiner Sur. 521, A-405. IPP 84.98 BOPD, 33.7°, open hole 5,295-5,319 ft. TD 5,319 ft. (New pool—East Charlotte area).

Bexar County: H & J Drilling Co. et al 1 Terrill, M. Gotaris Sur. 7, A-256. Dry. TD 1,691 ft.

Caldwell County: John W. Ellis 1 Joseph, Byrd Lockhart Lge. Dry. TD 2,030 ft.

Stan-Band Oil Co. 1 Fowler, J. Lawrence Sur. Dry. TD 1,776 ft.

Gonzales County: Rodney DeLange et al 2 Simmons, A. Dillard Sur., A-193. Dry. TD 2,218 ft.

LaSalle County: Standard Oil Co. of Texas 1 South Texas Syndicate 2, H&GN Sur. 67, A-233. IP (pre-potential gage) 828 M.c.f. daily, 14/64-in., perforations 10,258-326 ft. and 10,340-46 ft. TD 11,525 ft. (New field.)

McMullen County: Schorre, Spark & Thompson 1 Martin, HT&B Sur. 19. Dry. TD 705 ft.

Travis County: Goma Drilling Co. 1 Cowan,

WILDCAT COMPLETIONS

Gordon C. Jennings Lge. Dry. TD 1,730 ft.

M. J. Simmons and O. E. Greathouse 1 Carlson, J. H. Neeley and O. O'Brien Surs. Dry. TD 1,127 ft.

District 4

Aransas County: C. G. Glasscock 1 State Tract 2, Block 2, North Copano Bay. Dry. TD 7,504 ft.

Duval County: Bridwell Oil Co. 1 Rafael Garcia, Lot 37, Phillips Drilling Co. Oil & Gas Subd., Jose Marcello Ynojosa Sur., A-628. Dry. TD 6,054 ft.

A. G. Hill 1 Benavides, Lot 24, Share 2, Mesquite Oil & Gas Co. and J. Carpenter Subd., El Mesquite Sur., A-612. Dry. TD 3,512 ft.

Oceanic Oil Co. 1 Gertrudis Canáles Est., Jose Marcello Hinojosa Sur., A-628. IP 17.95 BOPD, 3/16-in., 44°, Hiawatha sand 5,050-57½ ft. (perforations). TD 6,115 ft. (New field—Dubose.)

Jim Hogg County: Texita Oil Co. and Parker & Gill 2 Villarreal et al, Block 4, Share F, NE½ Charco Redondo Grant. Dry. TD 2,402 ft.

San Patricio County: Houston Natural Gas Production Co. 1 Pulliam, Richard Eggleston Sur., A-116. Dry. TD 10,018 ft.

TEXAS GULF COAST

District 2

Bee County: Glen A. Martin 1 Schubert, O. H. Delano Sur., A-153. Dry. TD 4,707 ft.

Goliad County: Daugherty & Kidd 1 Welch, Joseph T. Kilgore Sur., A-172. Dry. TD 4,270 ft.

Jackson County: Henshaw Brothers and K. D. Harrison 1 "L" Ranch, D. A. Hoffman Sur., A-33. Dry. TD 9,018 ft.

Lavaca County: Gulf Oil Corp. 1-A Goodrich et al, Moses Wooten Sur., A-496 (Southeast Hallettsville area). Dry. TD 11,019 ft.

Victoria County: Kirkwood & Co. and George H. Coates 1 Brady, T&NC Sur., A-472. Dry. TD 6,020 ft.

District 3

Brazoria County: Jack W. Frazier et al 1 Pursley, K. R. Ehrman Sur., A-455. Dry. TD 9,511 ft.

Chambers County: San Juan Exploration Co. 2 Middleton et al, R. E. Boothe Sur., A-34. Dry. TD 8,688 ft.

Fort Bend County: R. O. Mangum 1 George, Block 31, J. H. Polly Sur., A-70. Dry. TD 5,725 ft.

P. R. Rutherford et al 1 Darby et al, Thomas Barnett Sur., A-7. Dry. TD 8,129 ft.

Hardin County: Brewster-Bartle Drilling Co., Inc., 1 Sternenberg et al, James McKinney Sur., A-393. Dry. TD 7,715 ft.

Harris County: The Texas Co. 1 Bader, Section 1, Harris County School Land Sur., A-332. Dry. TD 7,081 ft.

Slick Oil Co., Ltd., 1 Fosyer, Amasa Turner Sur., A-757. Dry. TD 8,775 ft.

Liberty County: Gulf Coast Leaseholds, Inc., 1 Seaberg, T&NO Sur., A-357. IP 93 BOPD, ¼-in., 38.3°, Yegua 8,116-39 ft. (perforations). TD 8,990 ft. (New pay in Martha field.)

C. N. Housh 1 Champion, Jordon West Sur., A-116 (Cleveland area). Dry. TD 9,498 ft.

Montgomery County: W. Ridley Wheeler et al 1 Womack, Joseph P. Harrison Sur., A-278. Dry. TD 8,005 ft.

Tyler County: Ada Oil Co. 1 Valkinberg, C. J. Knox Sur. (South Hyatt area). Junked hole. TD 10,525 ft.

Waller County: R. O. Mangum 1 Peters et al, James A. Darby Sur., A-297 and 298. Dry. TD 8,027 ft.

EAST TEXAS

Anderson County: Gray & Phillips 1 Earleys Chapel A.M.E. Church, W. B. Harrison Sur., A-348. Dry. TD 4,925 ft.

Henderson County: Roosth & Genecov Production Co. 1 Allison, L. D. Stover Sur. Dry. TD 3,514 ft.

Sorelle & Sorelle and K. Hughes 1 Swancy, Mathew Goliher Sur., A-9. Dry. TD 5,432 ft.

Houston County: L. A. Grelling 1 Brown, S. C. Collison Sur., A-241. Dry. TD 6,117 ft.

Kaufman County: Four W Oil Co. 1 Fitzgerald, Ezekiel Higdon Sur., A-197. Dry. TD 3,525 ft.

Leon County: Harvey Park Co. 1 Wilson, F. A. Richardson Sur., A-722. Dry. TD 8,207 ft.

Smith County: D. D. Feldman Oil & Gas Co. 1-A Verner estate, B. Kuykendall Sur., A-532. Dry. TD 5,348 ft.

L. A. Grelling and American Liberty 1 Moore, W. Miller Sur., A-638. Dry. TD 4,525 ft.

TEXAS PANHANDLE

Carson County: Skelly Oil Co. 1 Skelly-Schaffer, 4-88, I&GN. Dry. TD 5,990 ft. Salt water disposal well.

WEST CENTRAL TEXAS

Callahan County: I. A. Parmer 1 Dugan, Sec. 72, BBB&C Sur. Dry. TD 1,822 ft.

Sorrells Oil Co. 1-A Cutbirth, M. J. Webb Sur. 2. Dry. TD 2,363 ft.

F. C. Lattner 1 Booth, 7-6-SPRR, 6 mi. NW Oplin. IPP 34 BOPD, 40°, GOR 250, sand pay 1,766-72 ft. TD 1,805 ft.

Coleman County: Black-Dorbandt & Ross 1

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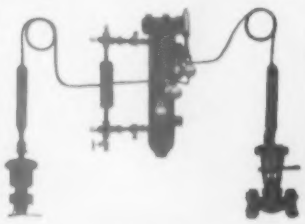
they are CAUSED!



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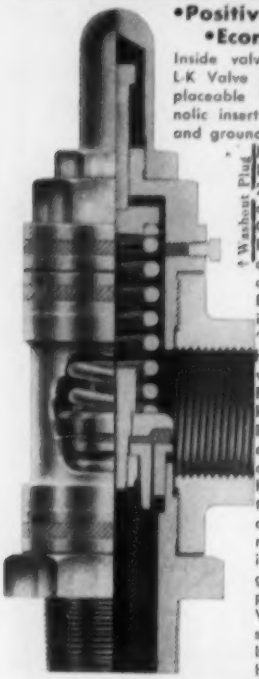

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WILDCAT COMPLETIONS

Haynes, P. Young Sur. 494. Dry. TD 1,830 ft.

Guy E. Chapman 1 Hughes, M. B. Tatem Sur. 741. Dry. TD 2,229 ft.

Kirk & Neeb 1 Strosier, Andrew Gable Sur. 271. Dry. TD 1,990 ft.

Harry Todd 1 Hudson, 73-2-GH&H. Dry. TD 3,775 ft.

Haskell County: Foree-Thomas Drilling Co. 1 Russell, 3-14-H&TC. Dry. TD 5,584 ft.

Jones County: D-H-H-B Drilling Co. 1 Carter, 33-10-T&P. Dry. TD 5,000 ft.

Shackelford County: Sinclair Oil & Gas Co. 1 Green, Sec. 815, TE&L Sur., 10 mi. NE Albany. IPP 30 BOPD, 44°, GOR 210, Ellenburger 4,596-4,605 ft. TD 4,623 ft.

Stephens County: Gilchrist Drilling Co. 1 Vick, 57-5-T&P, 2 mi. N Necessity. IP 103 BOPD, 16/64-in., 40°, TP 340 psi., GOR 435, Strawn, 2,751-57 ft. TD 3,309 ft.

Taylor County: Ard Drilling Co. and D. M. Grubbs 1 Doan, 64-19-T&P. Dry. TD 5,909 ft. Elev. 1,976 ft., Ellenburger 5,461 ft., Cambrian 5,885 ft.

NORTH TEXAS

Archer County: Dublin-Kiel 1-B Petrex, Blk. 26, ATNCL Subd. Dry. TD 1,631 ft.

R. McCasland 1 Burkett, TE&L Sur. 2417. Dry. TD 1,339 ft.

Scott Bros. et al 1 Rose Sebring, 16-4-H&TC. Dry. TD 3,172 ft.

Baylor County: Bander & Couch 2 Bartos, 36-45-H&TC. Dry. TD 1,531 ft.

Loyd, Menefee & Parlsey 1 Portwood, TE&L Sur. 2494. Dry. TD 1,931 ft.

Cooke County: Day Oil Co. 1 Bonner, N. Canto Sur. 209. Dry. TD 1,895 ft.

Denton County: Felderhoff Bros. Drilling Co. 1 Schenelle, S. Yoachum Sur. A-1443. Dry. TD 2,180 ft.

Grayson County: Ralph Abbey 1 Dickey, James Coryell Sur., A-261, 1 mi. SE Sandusky field. IP 417 BOPD, ¼-in., 32°, TP 550 psi., GOR 1,200, Pennsylvanian 7,645-7,772 ft. TD 7,783 ft.

Howell, Holloway & Howell 1 Texas Nurseries, James Strickland Sur., A-1068. Dry. TD 5,129.

Jack County: Warren Petroleum Corp. 2 Lupton-Brown, Thos. Lewellyn Sur., A-358, 5 mi. E Jacksboro. IP 19 BOPD, 48/64-in., TP 80 psi., pay 5,460 ft. TD 5,619 ft.

Knox County: D. D. Strange 1 Hunt, Blk. 17, J. Garner Sur. Dry. TD 1,585 ft.

Wise County: Byrd Oil Corp. 1 Pearson, D. Mangum Sur., A-560, 2 mi. S Cottonwood. IP 2,900 M.f.g., plus 4.93 bbl. distillate per 1,000 M.f.g., TP 1,220 psi., conglomerate pay 5,200 ft. TD 6,765 ft.

Young County: Fowler & Grace 1 Allison, TE&L Sur. 241, 4 mi. S Olney. IP 147 BOPD, flowing and pumping, TP 95 psi., 43°, top Caddo pay 4,079 ft. TD 4,089 ft.

Wilford Fultz 1 McLauren, T. K. Criswell Sur., A-2071. Dry. TD 2,630 ft.

T. V. Gorman 1 Burnett, S. D. Stinnett Sur., A-1529. Dry. TD 2,581 ft.

Trans-Tex Drilling Co. 1 Pringle, TE&L Sur. 1467. Dry. TD 3,217 ft.

WEST TEXAS

Andrews County: Hunt Oil Co. 1 Williamson, 2-A33-PSL. Dry. TD 8,050 ft. Elev. 3,271 ft., Wolfcamp 7,774 ft.

F. Kirk Johnson 4 Pattillos, 22-A36-PSL, 4 mi. NW Andrews. IP 331 BOPD, 32/64-in., 34°, GOR 1,600, TP 75 psi., pay 4,476 ft. TD 4,600 ft.

Culberson County: Phillips Petroleum Co. 1 Crews, 22-59-T&P. Dry. TD 7,609 ft. Elev. 3,603 ft. estimated, Delaware sand 2,646 ft., Devonian 5,430 ft., Simpson 6,640 ft., Ellenburger 7,388 ft.

Gaines County: Hall & Stewart Drilling Co. and Auld 1 Klattenhoff, 3-295-Reagan CSL. Dry. TD 12,891 ft. Elev. 3,144 ft., Wolfcamp 9,477 ft., Devonian 12,855 ft.

Howard County: Cosden Petroleum Corp. 1 Simpson, 22-33-T3N-T&P. IP 216 BOPD, ½-in., 42°, TP 110 psi., GOR 500, reef pay 8,620 ft. TD 8,653 ft.

Pecos County: McMillan Petroleum Corp. 1 Boren & Boren, L. Merchant Sur. Dry. TD 3,257 ft.

Schleicher County: Ashland Oil & Refining Co. 1 Brown, 79-H-GH&SA. Dry. TD 5,536 ft.

C. L. Norsworthy Jr. 1 Womack, 34-1-GH&SA. Dry. TD 5,315 ft.

Tucker Drilling Co. 1 Williams, 30-1-GH&SA. Dry. TD 5,614 ft.

Tucker Drilling 1 Davis estate, 12-9-TW&NG. Dry. TD 6,215 ft.

Sutton County: El Paso Natural Gas Co. 1-A Shurley, 73-C-HE&WT. Dry. TD 770 ft.

Terry County: F. Kirk Johnson 1 Haybeck, 34-D11-C&M. Dry. TD 7,010 ft.

Tom Green County: Phillips Petroleum Co. 1 Edmund, 17-24-H&TC. Dry. TD 6,900 ft. Elev. 2,296 ft., Ellenburger 6,000 ft.

Gray Wolfe Co. 1 Abe Mayer estate, John Dunman Sur. 1802. Dry. TD 7,060 ft.

WEST TEXAS BORDER COUNTIES

Coke County: F. W. Holbrook 1 Percifull, J. Baker Sur. 461. Dry. TD 3,718 ft.

Runnels County: Robert B. Cockrell 1 Frick, 69-63-CTRR. Dry. TD 4,700 ft.

S. C. Herring Drilling Co. et al 1 Bragg, H. S. Perkins Sur. 95. Dry. TD 4,000 ft.

Thos. D. Humphrey & Sons 1 Ashton, Sec. 160, J. H. Wilson Sur., 6 mi. E Ballinger. IPP 20.8 BOPD, 36°, pay 2,328 ft. TD 2,522 ft.

Thos. D. Humphrey & Sons 1 Mueller, Blk. 233, R. M. Williamson Sur. Dry. TD 4,147 ft.

Murray Petroleum Co. 1 Eager, Sec. 1, W. H. Gee Sur. Dry. TD 4,678 ft.

Stonewall County: Humble Oil & Refining Co. 1 Spitaer, 1-9-AB&M, 3 mi. W Old Glory. IPP 14.4 BOPD, 38°, pay 5,986 ft. TD 6,532 ft.

The New Seven Falls Co. 1 Ellison, 114-D-H&TC, 8 mi. N Aspermont. IP 154 BOPD, 10/64-in., 39°, GOR 507, TP 225 psi., pay 6,140 ft. TD 6,149 ft.

SOUTHEAST NEW MEXICO

Chaves County: Joseph I. O'Neill Jr. 1 Williams, 33-14s-31e. Dry. TD 2,926 ft.

Roland Rich 1 Queen, 35-13s-31e. IPP 216 BOPD, pay 3,053 ft. TD 3,060 ft.

Lea County: Warren Petroleum Corp. 1 Cox, 21-14s-38e. Dry. TD 13,375 ft. Elev. 3,786 ft., Pennsylvanian 10,130 ft., Devonian 13,217 ft.

NORTHERN NEW MEXICO

Colfax County: Continental Oil Co. 4 St. Louis, Rocky Mountain, and Pacific RR Co., NE NE SW 17-29n-22e. Dry. TD 4,709 ft. Intrusive sill.

McKinley County: Elmer L White 2 Santa Fe, SE SE NE 13-15n-10w. Dry. TD 1,235 ft. Dakota.

San Juan County: Lucille H. Pipkin 2 Pipkin, NE SW NE 31-30n-14w. Temp. abd. TD 820 ft. Pictured Cliffs.

ILLINOIS

Christian County: F. F. Frederick 1 Sample, 30-15n-2w. Dry. TD 2,005 ft.

Clark County: Great Lakes Carbon Corp. 1 Bash, 23-10n-11w. Dry. TD 1,455 ft.

Clinton County: Schiermann & Imming 1 Park Comm., NW NW NW 31-2n-2w. Dry. TD 2,605 ft.

Fayette County: H. Mabry et al 1 Bingaman, SW SW SE 2-5n-1w. Dry. TD 2,928 ft.

WILDCAT COMPLETIONS

Macon County: D. McCumber 1 Bruce, SW SE NE 7-16n-1e. Dry. TD 1,927 ft.
Madison County: J. L. Jefferies 1 West Comm., N½ NW SW 12-5n-8w. Dry. TD 495 ft.
Marion County: B. Montgomery 1 Dietrich, NW SW NW 12-4n-3e. Dry. TD 2,364 ft.
Montgomery County: C. J. Simpson 1 Simonin, SW SW SW 23-7n-3w. Dry. TD 2,373 ft.
Randolph County: Jet Oil Co. 1 Guebert, SE NW SW 7-4s-6w. Dry. TD 1,636 ft.
Sangamon County: J&D Kykendall Drilling Co. 1 Munson, SE SW SE 8-15n-3w. Dry. TD 1,800 ft.
Washington County: Jet 1 Sterns, SE SW SE 10-3s-4w. Dry. TD 1,401 ft.

INDIANA

DuBois County: Beard 1 Sendelweck, NE NE SE 3-2s-6w. Dry. TD 1,100 ft.
Noble County: Arnold Lewis 1 C. L. Moody-McBride Comm., NW SW SW 33-35n-8e. Dry. TD 2,201 ft.
Pike County: C. S. Higgins 1 Solat, SE NE NE 15-3s-8w. Dry. TD 1,703 ft.
Vanderburg County: C. R. Craft 1 Angemar, NE NW SE 36-4s-11w. Dry. TD 2,143 ft.

KENTUCKY

Caldwell County: Bath et al 1 Harper, NE SW NW 8-I-19. Dry. TD 811 ft.
Christian County: R. P. Craft, Trustee 1 Jagoe heirs, NE SW NE 19-G-26. Dry. TD 773 ft.
Henderson County: Eagle 1 Fulkerson, SW SW NW 21-O-25. IPP 10 BOPD, Cypress 1,954-61 ft. TD 1,961 ft. (Opens East Rangers Landing field.)
J. Harvey Snider 1 Pride-Morris, SE NE NE 4-P-26. Dry. TD 2,215 ft.

MICHIGAN

Arenac County: C. W. Collin 1 Johnson, SE NE SW 31-19n-5e. Dry. TD 3,030 ft. in Dundee.
J. E. Bauer 1 State-Moffatt, SW NE NW 27-20n-3e. Dry. TD 4,457 ft. in Richfield.
Berrien County: Turner Petroleum Corp. 1 First, et al, S½ NW NE 12-5s-17w. Dry. TD 891 ft. in Traverse lime.
Roscommon County: Sun Oil Co. 1 State-Lyon, NW NW NE 21-24n-4w. Dry. TD 4,654 ft. in Richfield.
Van Buren County: Ford Oil Co. 1 Abbott, SE NE SE 26-4s-14w. Dry. TD 1,150 ft. in Traverse lime.

WEST VIRGINIA

Mercer County, Plymouth district: United Fuel Gas Co. 8180 J. B. Eads, elevation 1,764 ft. Dry. Maxon sand, 782-862 ft. and 1,060-83 ft. gas shows at 830 ft. and 1,075 ft., Big lime 1,384-2,796 ft., gas shows 1,075 and 1,942 ft., Berea sand 3,393-3,425 ft., Weir sand 2,973-3,075 ft. gas show 3,037 ft., TD 3,504 ft.

MISSISSIPPI

Washington County: Marine Production Co. 1 Trotter, 35-16n-8w. Dry. TD 3,744 ft. Elev. 120 ft., Tuscaloosa 3,438 ft.

SOUTH LOUISIANA

Acadia Parish: California Co. 1 Wilfert et al, 11-7s-1w. Dry. TD 9,300 ft.
Beauregard Parish: W. S. Boyle et al 1 Newport, 25-5s-11w. Dry. TD 8,507 ft.
Calcasieu Parish: Louis J. Roussel 1 Fontenot et al, 16-11s-6w. Shut-in gas-condensate well, no gage, perforations 10,920-56 ft. TD 11,870 ft. (New pay in Bell City field).
Douglas Whitaker 1 Walker, 29-10s-6w. Shut-in gas well, no gage, perforations 10,710-20 ft. TD 10,800 ft. (Extends Holmwood field).
Jefferson Davis Parish: Kirby Petroleum Corp. 1 Powell, 30-7s-4w (North Edna area). Dry. TD 8,775 ft.
Texas Crude Oil Co. 1 McBurney, 33-7s-4w. Dry. TD 8,950 ft.
Lafourche Parish: Sinclair Oil & Gas Co. 1 State Lease 2490, Timbalier Bay. Dry. TD 12,105 ft.
Southern Production Co., Inc., 1 Godchaux, 36-15s-18e. Dry. TD 11,510 ft.
Plaquemines Parish: Union Oil Co. of California 1 Lubben et al, 48-19s-17e (Fort Jackson area). Dry. TD 11,500 ft.
Shell Oil Co. 1-B State Lease 1007, Block 23, South Pass area, Gulf of Mexico. IP 200 BOPD, 11/64-in., 31.9°, perforations 7,350-60 ft. TD 10,950 ft. (Extends Block 27 field).
St. Martin Parish: Atlantic Refining Co. 1 State Lease 2379 ft.o, 15-15s-13e. Dry. TD 14,009 ft.
St. Mary Parish: Southern Natural Gas Co. 2 Zenor, 42-15s-11e. IP 156 BCPD and 5,250 M.c.f. daily, 14/64-in., 44.2°, perforations 13,266-80 ft. TD 13,501 ft. (New pay in Patterson field.)

NORTH LOUISIANA

Bossier Parish: R. H. Smith 1 Thigpen & Herold, C NE NE SW 15-20n-13w. Dry. TD 2,194 ft.
Hunt Oil Co. 1 M. B. Rodgers et al Unit, 11-23n-14w. Dry. TD 6,998 ft.
Caddo Parish: Union Producing Co. 1 Querbes, 17-16n-16w, IP 7,000 M.c.f. of gas per day, Cotton Valley "D" sand 8,535-53 ft. TD 8,923 ft. (New pay in Bethany field.)
West Carroll Parish: A. W. Phillips 1 Bruce Lumber Co., C NE NE SW 14-20n-9e. Dry. TD 7,025 ft.
Catahoula Parish: Justiss-Mears Oil Co. and

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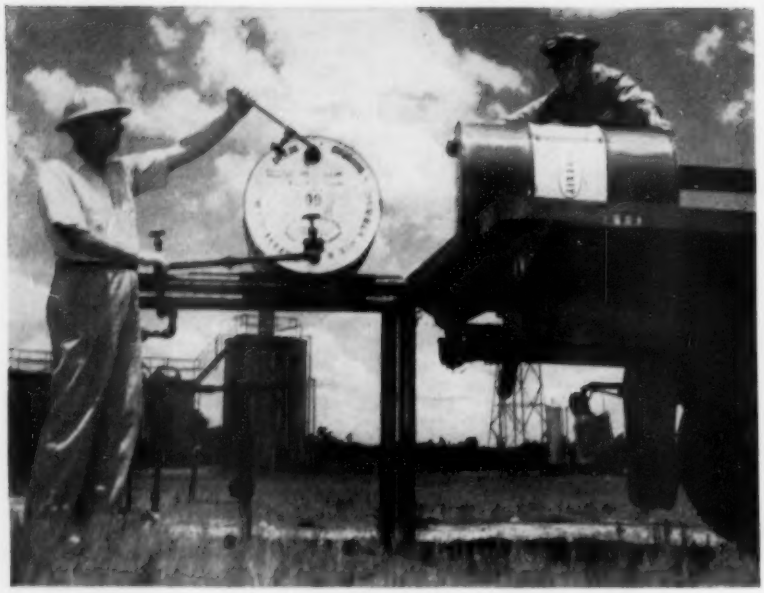

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WILDCAT COMPLETIONS

Serio-Punches Oil Co. 2 Justiss-Allbritton, 27-7n-6e. Dry. TD 5,535 ft.

LaSalle Parish: Magnolia Petroleum Co. 4 Urania Lumber Co., 30-11n-2e. Dry. TD 3,970 ft.

Natchitoches Parish: E. C. Wentworth-Natchez Drilling Co. 1 Safford, 34-11n-10w. Dry. TD 2,005 ft.

Red River Parish: Agurs Oil Co. 1 Waller, 32-14n-10w. Dry. TD 1,702 ft.

Tensas Parish: Gauthier & Heard-W. L. Billups 1 Dale, 26-10n-9e. Dry. TD 5,810 ft.

Union Parish: Terrell 1 Gatson, C SE SE NW 10-23n-1w. Dry. TD 2,242 ft.

OKLAHOMA

Beaver County: Fryer & Henson 1 Shaddin, C SE SE 26-3n-24eCM. IPF 28 BDPD, 6,000 M.c.f. 5,476-96 ft. TD 7,795 ft (Gas-distillate discovery.)

Carter County: Beach & Talbot 1 Lyles, SW SW NE 28-2s-2w. Dry. TD 6,539 ft.

Cleveland County: Shell Oil Co. 1 Jones, NE SE NE 12-10n-3w. Dry. TD 7,162 ft.

Cimarron County: Shamrock Oil & Gas Co. 1 Mathis-Davis, NW NW SE 16-6n-8eCM. Dry. TD 4,760 ft.

Creek County: Deep Rock Oil Corp. 1-B Wheeler, SE SW NW 6-16n-8e. Dry. TD 3,755 ft.

Grant County: L. J. Horwitz 3 Bowling, SE SW SE 31-26n-5w. Dry. TD 6,406 ft. Geol. wildcat in East Grant-Pond Creek.

Greer County: W. C. Lidell et al 1 Jewell, NE NE NE 32-7n-21w. Dry. TD 1,073 ft.

Jackson County: Ray Brown et al 1 Holmes, NE SE NW 27-1s-20w. Dry. TD 1,501 ft.

Jefferson County: Mack Oil Co. 1 Scheer, NE NE NW 35-7s-6w. Dry. TD 3,380 ft.

Roy M. Johnson 1 Neff, NE NW SW 32-3s-4w. Dry. TD 695 ft.

J. G. Sullivan 1 Faulkner, NW NE SW NW 11-4s-4w. Dry. TD 1,300 ft.

Kay County: R. D. Creighton 1 Muret, NW NW SW 25-27n-1e. Dry. TD 3,906 ft.

Currey, Sheilds & Curry 1 Buesing, SW SW SW 31-27n-4e. Dry. TD 3,518 ft.

Joe Wyant 1-A Hoisington, SE SW NE 31-25n-2w. Dry. TD 3,673 ft.

O. H. Parker 1 Covill, SE SE 12-26n-3e. Dry. TD 3,496 ft.

Lincoln County: Davidor & Davidor 1 Bailey, NW NE SE 26-14n-2e. Dry. TD 3,804 ft.

Ellison et al 1 Stasta, NE SE NW 3-12n-6e. Dry. TD 4,570 ft.

Logan County: J. M. Shields 1-A State, NE NE SE 36-16n-1e. IP 21,700 M.c.f. of gas per day, 11 BD per mil., Misener sand 4,940-49 ft. TD 5,365 ft. (Gas-distillate discovery.)

British-American Oil Producing Co. 1 Oklahoma, NE NE NW 36-17n-1e. Dry. TD 5,171 ft.

Noble County: T. T. Eason 1 Dupy, NE NE NW 29-23n-1w. Dry. TD 1,980 ft.

Okfuskee County: Anderson Plenk Arnao 1 McMahon, NE NE NE 35-12n-9e. Dry. TD 3,640 ft.

Oklahoma County: C. H. Nicholson 1 Doster-A, SE SE SE 28-14n-1e. IPF 4 BPH, ½-in., Skinner sand 5,084-91 ft. TD 5,114 ft. (Oil discovery.)

Okmulgee County: Pittsburgh Plate Glass Co. 1 Wynne et al, NE SW NE 5-11n-13e. Dry. TD 3,193 ft.

Pawnee County: R. S. Bond 1 Brown, NW NE NW 24-21n-5e. Dry. TD 3,150 ft.

Pottawatomie County: Johnson & Gill 1 Hubbard, NE NE NW 23-9n-2e. Dry. TD 5,379 ft.

Stephens County: Toklan Production Co.-Lone Star Producing Co. 1 Timis "A,"

(Continued on page 208)

PERSONALS

Tongberg Promoted

Unscientific hole in one boosts scientist's renown

DR. CARL O. TONGBERG, newly appointed vice president of Standard Oil Development Co., has compiled an impressive list of accomplishments during the years he has spent in petroleum research. But his renown in the laboratory is rivaled by that on the golf course.

His fame as a golfer came suddenly —and unexpectedly—one day when he was shooting on a Canadian course. He made a hole in one, and thus became a member of that elite group known as the Hole in One Club of Canada.

Although he describes his golf game as mediocre, he is still trying to convince himself and his friends that the dreamed-of performance was no accident.

The scientist . . . Tongberg started his research career as a youngster when his high school teacher at Lynn, Mass., got him interested in chemistry.

He continued his chemistry studies at Harvard University, where he received his bachelor's degree in 1927 and his master's degree in 1930. While an undergraduate, he worked as a laboratory assistant to James B. Conant, later president of the university and U. S. commisisoner in West Germany.

It was Conant who urged him to enter graduate work. One job assigned to him by Conant was the somewhat unscientific task of checking weather reports for each Saturday during football season, Tongberg recalls.

In 1930 Tongberg went to Pennsylvania State College, where he was attracted by a grant for petroleum research just passed by the state. He became a research associate and later an assistant professor at Penn State, and he got his doctorate there in 1936.

Tongberg decided to go into industry in 1937 while working on a college research project under contract with Standard Oil Development Co. He chose S.O.D., an affiliate of Standard Oil Co. (N.J.), largely because of the efforts of William Sweeney and George Maverick, with whom he had been in contact while on the company-supported project. He felt his temperament was better suited to application and development than to pure scientific research.

At first he did process development work for S.O.D., his first assignment being in fluid catalytic cracking. He also did some work on alkylation, isomerization, and lube additives.

Tongberg has published papers on a wide variety of research studies, including biochemistry (during his Harvard days), reactions under high pressures, and extraction and distillation studies in his Penn State work on composition of petroleum. He also has written on research management. He holds a number of patents, the most important of which he believes to be in solvent extraction.

Promotions have come fast—to assistant director then director of the company's research division, and in January 1954, to coordinator responsible for S.O.D.'s entire work on research and development of petroleum products. In his latest promotion, Dr. Tongberg became not only a vice president but a member of the executive committee and a director of the company.

The man . . . At 48 Tongberg has become one of the most influential men in one of the world's leading petroleum-research companies. His interest in administration, say his associates, has led him to the delegation of responsibility and the training and development of subordinates.

His fellow workers consider Tongberg basically optimistic—a valuable attribute to the researcher.

Dr. Tongberg lives at Westfield, N. J., with his family, which includes two sons—Richard C., 10, and Carl N., 16.

He is said to be a better-than-average bowler, although he has never received the acclaim in that sport that his "mediocre" golf game has brought. He also is interested in color photography and has a wide collection of 35 mm. slides.

W. W. Poimboeuf, Jr., petroleum engineer for Continental Oil Co. at Ponca City, Okla., has been transferred to Oklahoma City.

W. A. Hovis has retired as assistant superintendent of production and storage for United Natural Gas Co., Oil City, Pa. The retirement, effective December 1, marked the end of 45 years of continuous service with the company.

DR. HEWLETT

Dr. Amiot P. Hewlett has been appointed vice president of Standard Oil Development Co., along with **Dr. Carl O. Tongberg** (see personality sketch). Hewlett has been associated with the company since 1930 and formerly served as general administration manager.

J. W. Hargrove, secretary and treasurer of Texas Eastern Transmisison Corp., has been elected a vice president of the company. In assuming responsibility for the company's financial affairs, he will give up his post of treasurer to **B. P. Smith, Jr.,** who has been general auditor.

W. G. Iverson, chief geologist for Derby Oil Co., has resigned to become a consultant and independent operator in Wichita, Kans.

Kenneth C. Woodyard, Houston, has been appointed division geophysicist at Shreveport, a newly created position, by Continental Oil Co. Woodyard formerly was in Conoco's southern region headquarters geophysical section at Houston.

Howard G. Briggs has been named general process superintendent in the manufacturing department of Standard Oil Co. of Ohio. **Napier J. Box** succeeds Briggs as distillation superintendent, and Box's position as distillation foreman has been given to **Richard W. Ballmer.**

Mel A. Pyeatt, formerly district production superintendent at Anson, Tex., for General American Oil Co. of Texas, has been transferred by the company to Abilene, Tex., as superintendent of its new central and northwestern Texas district. Also transferred to Abilene were: **E. A. Cason,** assistant production superintendent; **Ed Cobb,** district engineer; **Jack Speakman,** office manager;

PERSONALS

and **John Loflin,** engineer, hired recently after being graduated from the University of Texas with a B.S. degree in petroleum engineering.

John F. Binkley, former field superintendent at Sheridan, Wyo., with J. Ray McDermott & Co., Inc., has been promoted to division superintendent for the company at Denver.

Maurice Kamen-Kaye has resigned as chief geologist (sedimentary) of the Saskatchewan Department of Mineral Resources to join Conorada Petroleum Corp., New York, December 15. Kamen-Kaye will be responsible for supervision and appraisal of foreign properties for Conorada, which is jointly owned by Continental Oil Co., Ohio Oil Co., and Amerada Petroleum Corp. Kamen-Kaye, a graduate of the School of Mines in London, spent 20 years in geological work in Venezuela. Before joining the Department of Mineral Resources on January 1 this year he had operated in Regina since 1950 as a consultant to the Sohio Petroleum Co. group, Canadian Devonian Petroleums, Ltd., and others.

Frank Y. Speight has joined the staff of the American Society for Testing Materials, Philadelphia, as assistant technical secretary.

H. L. (Ted) Fanning, Jr., has been named general land manager of Three States Natural Gas Co. He will supervise land and leasing operations in a $3,100,000 exploration program planned by Three States in Colorado and Utah.

W. B. Clark, proration analyst for the Texas Railroad Commission, has resigned effective December 16 to join Magnolia Petroleum Co. at Dallas. Clark's work with Magnolia will be in unitization and matters concerning the Texas Railroad Commission.

H. E. Snow, a managing director of Anglo-Iranian Oil Co., Ltd., has been appointed general manager of Iranian Oil Participants, Ltd. Snow has resigned from the board of Anglo-Iranian to take over his new duties. Iranian Oil Participants is the holding company for the eight-company international consortium which operates the Iranian oil industry under the recent agreement with the Iranian Government.

M. Ray Reston, former district land man for Deep Rock Oil Corp., Tulsa, in the Rocky Mountains, Canada, and Texas and Oklahoma, has opened offices as an independent in Wichita Falls, Tex.

David J. Walsh, Chanslor-Western Oil & Development Co., has been elected president of the Oil Map Associaton, Los Angeles. **Larry Kelley,** Amerada Petroleum Corp., has been named vice president; **P. R. Janette,** Seaboard Oil Co., secretary; and **Patricia Metcalf,** Bell Petroleum Co., treasurer.

M. Burrows, former assistant manager of distillation, thermal cracking, and treating at the Shellburn, England, refinery of Shell, has been appointed assistant superintendent of the Montreal, Que., chemical plant of Shell Oil Co. of Canada, Ltd. He succeeds **H. L. C. Reynolds,** who has been transferred to the head-office manufacturing department.

Eldon V. Hunt has resigned as general manager of Key City Gas Co., Dubuque, Iowa, to become chief engineer of Alberta Gas Trunkline Co., Ltd., Calgary. Before joining Key City, Hunt was a division superintendent with Transcontinental Gas Pipeline Corp. and had served as construction superintendent for Ebasco Services, Inc., New York.

Benjamin C. Shaul, process superintendent, has been promoted to superintendent of engineering, maintenance, and construction at the Avon, Calif., refinery of Tide Water Associated Oil Co. In other Avon refinery promotions, **B. G. Jones** has been appointed superintendent of distillation and cracking; **Charles L. Persyn,** named superintendent of treating and lube-oil manufacturing; **H. L. Benson,** superintendent of shippng and utilites; and **Louis Mittleman,** named coordinator of technology. Mittleman will continue as chief chemist in charge of the refinery's control laboratories.

John A. Tench, manager of the Martinez refinery of Shell Oil Co., has been named manager of the company's 125,000-bbl. Houston refinery. He succeeds Paul E. Hurley, who died recently. **Bruno Stolley,** manager of the Emeryville laboratory of Shell Development Co., will succeed Tench as manager of the 55,000-bbl. Martinez refinery. **John R. Morrison,** assistant manager of Shell's industrial-relations department, has been named to take over management of the Emeryville laboratory.

Harry Morrison will become assistant general manager of the Western Oil and Gas Association, Los Angeles, January 1. Morrison for the past 7 years has been general manager of the Los Angeles Downtown Business Men's Association.

W. R. Yinger, formerly with Sunray Oil Corp. and Allied Materials Co., has been named head of the production department of Earlsboro Oil & Gas Co., newly formed Oklahoma City oil company. **Guy M. Steele, Jr.,** former chief geologist with Stephens Petroleum Co., Oklahoma City, is head of the geological department, and **L. E. Lansden, Jr.,** former partner in William E. Howell & Co., has been placed in charge of the land department.

F. A. Menkin has retired as vice president and manager of exploration in the western division of Tide Water Associated Oil Co. Menken will open offices as a consultant. Menken started with Tide Water in 1926 and since 1936 has headed the exploration department of the western division.

Roderick K. MacIvor, former Oklahoma City division water-flood engineer with Sohio Petroleum Co., has opened petroleum consultant offices there. MacIvor started with Sohio in 1948 as a drilling engineer at Centralia, Ill., and later directed water flooding operations for the company in Illinois and Kansas. MacIvor also served with Sohio in its water-flood research laboratories in Oklahoma City and did reservoir and evaluation engineering in Kansas, Oklahoma, and Texas.

J. J. Oliphant, General Petroleum Corp., was elected chairman of the San Joaquin Valley chapter of the American Petroleum Institute at a recent meeting in Taft, Calif. Other new officers include **H. D. Campbell,** Fresno Western Oil Co., first vice chairman; **H. M. Van Clief,** Honolulu Oil Corp., second vice chairman; **Hugh Mays,** Crescent Petroleum Co., adviser; and **Tob Torrey,** Southern California Gas Co., secretary-treasurer.

PERSONALS

James J. Hohler, geologist with Shell Oil Co., has been transferred from Baton Rouge to New Orleans.

Robert J. Lantz has resigned as a geologist with Union Oil Co. of California to join American Stratigraphic Co., Oklahoma City.

John W. Gendron has been appointed to the newly created position of manager of Tide Water Associated Oil Co.'s oil-purchase and exchange department.

W. A. BRAMLETTE

William A. Bramlette has been appointed chief geologist of Carter Oil Co., Tulsa. He succeeds **Merril W. Haas,** who last month became manager of Carter's exploration department. Bramlette, a 1932 graduate of Southern Methodist University, holds a master's degree from the University of Texas and a doctorate from the University of Kansas. He started with Carter in 1943 as a senior geologist in Billings, Mont. He became district geologist in the northwest division in 1946, assistant division geologist at Denver in 1948, and division geologist the same year. He was transferred to Tulsa as assistant chief geologist in 1953.

Mel A. Pyeatt has been transferred from Wichita Falls to Abilene, Tex., as division superintendent of the new divisional exploration office established there by General American Oil Co. of Texas.

Art L. Walker, Jr., Oklahoma City consultant, has been named to a new post as deputy conservation officer for the Oklahoma Corporation Commission.

Frank H. Sanders has resigned as a chemical engineer with Phillips Petroleum Co., Bartlesville, Okla., to join Arabian American Oil Co., New York. Sanders will head Aramco's refinery process design section.

Phillip C. Miller has been elected a vice president of Esso Export Corp. Miller joined Standard Oil Co. (N. J.) as an office boy 37 years ago, became supervisor of foreign traffic of Esso Export when the company was formed in 1944. In 1941, on loan to the British Government, he organized the Office of Petroleum Board in New York which helped maintain a flow of products to England during the war.

Dr. John M. Hersh, of the Petty's Island laboratory of Cities Service Research & Development Co., has been elected a fellow of the American Institute of Chemists.

Harry Riggs, Jr., petroleum engineer, has been transferred from Stroud, Okla., to Oklahoma City by Mid-Continent Petroleum Corp.

Harry R. Jukes, former petroleum engineer with Gulf Research & Development Co. at Harmarville, Pa., has been transferred to Buras, La., where he will serve as a petroleum engineer with Gulf Refining Co.

A. J. Kavanaugh, Oklahoma City, has been named an associate member of the Interstate Oil Compact Commission. He will serve as special representative to Gov. Johnston Murray of Oklahoma.

Robert G. Anderson has been elected a member of the board of directors of Atlantic Oil Corp. Other directors elected were: **Lewis M. Dabney, Jr., Harry B. Davis, Paul I. Johnston,** and **Roy F. Parkhill.** Officers of the company named by the board of directors include: Johnston, president; Davis, vice president; **M. E. Dale,** secretary and treasurer; and **John G. Arnold,** assistant secretary and treasurer.

W. O. Turner has been named president of Louisiana Gas Service Corp., a newly formed company which will take over all gas and water properties of Louisiana Power & Light Co. Other officers elected in addition to Turner include: **G. C. Rawls,** vice president; **A. E. Elliott,** secretary and treasurer; **A. B. Paterson,** vice president in charge of operations; **C. J. Puckett,** assistant secretary and assistant treasurer; and **A. W. Durning,** chief engineer.

J. W. Tomlinson, former general manager of Saskatchewan Power Corp., will join Trans-Canada Pipe Lines, Ltd., January 1, 1955. Tomlinson will headquarter in Toronto where he will be an assistant to **A. P. Craig,** vice president in charge of marketing. Tomlinson was graduated from the University of Manitoba in 1930 with a bachelor of science degree in electrical engineering. He is known throughout western Canada for his 12 years of service with the Manitoba Power Commission. While with the Power Corp., Tomlinson was in charge of construction of the Brock - Saskatchewan natural - gas pipeline system and the development of markets in Saskatoon and other towns fed by the line.

John S. Hegwer, petroleum engineer for Ohio Oil Co. at Cody, Wyo., has been transferred to Sidney, Neb.

A. H. Proctor has joined Schafer Drilling Co., Oklahoma City, as general manager of production. He recently retired as division production superintendent for Magnolia Petroleum Co. **John K. Hannifan,** geologist formerly with Shell Oil Co., also has joined Schafer.

DEATHS

Charles Eugene Crawley, former president of Sinclair Oil & Gas Co. and later a vice president and director of Consolidated Oil Corp., died November 25 at his home in New York. Crawley became president of Sinclair Oil & Gas when it was formed in Tulsa in 1916 and served in that capacity until moving to New York in 1919. He resigned as vice president of Consolidated in 1940 and later was affiliated for a time with the brokerage firm of Merrill Lynch, Pierce, Fenner & Beane.

Millard George Creighton, 40, president and general manager of Creighton Oil Tool Co. and president of International Drilling Co., Long Beach, Calif., died recently in Caracas while on an inspection tour of Venezuela.

Franklyn Rockefeller Kenney, one-time president of the old Marland Oil Co. of California and later an executive in Kettleman Oil Corp., died recently in Los Angeles. He was one of the early developers of Kettleman Hills field.

Philip H. Patchin, 70, former vice president of Standard Oil Co. of California, died November 29 at his home in San Mateo, Calif.

Christopher J. Rickert, 82, former night superintendent of the Bayonne refinery of Esso Standard Oil Co., died November 28 at his home in Roselle, N. J.

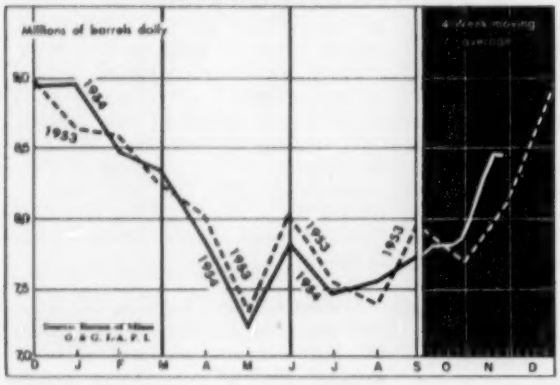
Reginald R. Brinkman, 56, president of Highland Oil Co., Shreveport, and vice president of Triangle Refineries, Inc., Houston, died November 30 in Shreveport.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,272,825	UP	400	DOWN	8,365
Crude stocks	269,679,000	UP	2,630,000	DOWN	15,095,000
Completions	1,022	DOWN	20	UP	14
Refinery runs	6,974,000	DOWN	42,000	DOWN	109,000
Gasoline stocks	149,191,000	UP	1,967,000	UP	1,507,000
Four-product stocks	375,864,000	UP	1,260,000	UP	9,085,000
Total imports	1,050,400	DOWN	108,800	DOWN	116,300

TOTAL DEMAND—ALL OILS



Major-Independent Relations in Gulf Areas Vitally Important Marketwise

ONE of the outstanding developments of the postwar period has been the growth of the independent refining industry in the Texas and Louisiana Gulf Coast areas. The operations of these plants have an important bearing on domestic and world-wide product prices and the declines in their quotations over the past year have adversely affected all markets including the adjoining interior refining centers.

Unlike most independent refinery operators in other areas, those of the Gulf Coast have been accustomed to selling the bulk of their products to the large integrated refiners in the Gulf and East Coast areas whose own operations did not supply all of their requirements.

In recent months the question has been raised as to whether the larger refineries of the Gulf and East Coast areas will continue to need the output of the independent operators. The fact that some of the large integrated units have already reduced their purchases from independent sources has been a factor in the price declines of the past year.

Comparative data show substantial increases in the capacities of most of the major coastal refinery operations over the past 3 years. This was brought about partially through the urging of the Government which asked refiners to provide to excess capacity as a defense measure to be used in the event of a national emergency.

Reflecting both this policy of building excess capacity and some curtailment of operations because of heavy inventories, a recent 4-week period showed East Coast refiners were operating at 83.3 per cent capacity; Texas Gulf Coast at 88.9 per cent capacity; and Louisiana Gulf Coast at 88.6 per cent capacity. This meant in effect that 550,500 bbl. daily of refinery crude capacity was not used.

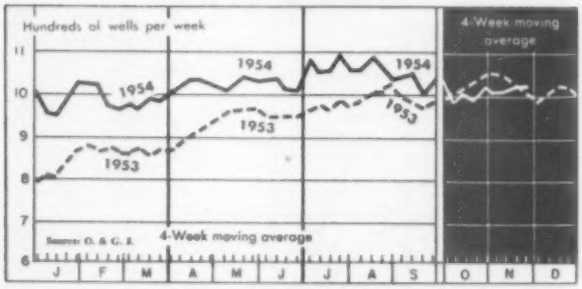
As of the first of the year there were 15 independent refineries on the Texas Gulf Coast with a capacity of 350,100 bbl. daily and 8 plants on the Louisiana with a capacity of 35,600 bbl. daily. In the Texas Gulf Coast the independents had 17 per cent of the total capacity and on the Louisiana Coast about 6 per cent of the capacity.

The foregoing data are being offered in support of the contention that the large integrated refiners as a group are now in a position to cease purchases from Gulf Coast independent refiners. If this should happen, it is pointed out by other observers, the independents would be forced to look to jobbers and increased exports for outlets at whatever prices necessary to get the business. They would thus come in direct competition with the larger refiners.

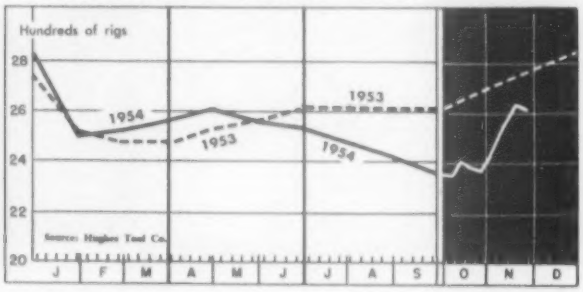
There has been some indication as to what this would mean in recent months. A few independents have not been able to dispose of all of their output locally and to the larger buyers and have moved some of their output inland via the Mississippi River. This situation has been aggravated by the lack of adequate markets for the motor-fuel products of cycling plants and some of this excess has also been moved up the river. The net result has been distress prices, the greatest weakness in the Middle West and Mid-Continent marketing areas centering at Mississippi River terminals.

The obvious answer to this situation, according to market observers, is for the large refiners to continue and possibly enlarge their purchases from the independents to the end that orderly markets can be maintained and the dumping of excess supplies on interior, coastal and foreign markets will end.

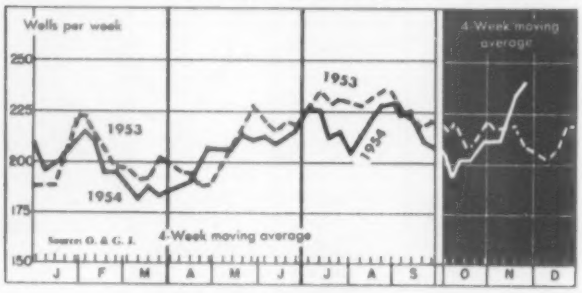
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES.



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS

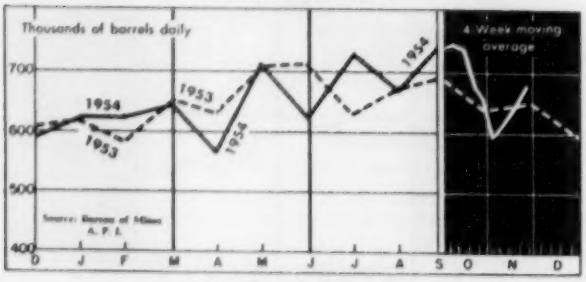
Area—	11-29-54	Change from 11-22-54	Change from 11-30-53
Gulf Coast	544	—20	— 48
N. and W. Texas-New Mexico	815	—16	— 58
Arkansas-N. Louisiana-E. Texas	187	—11	— 14
Oklahoma	329	5	— 51
Kansas-S. Nebraska	184	1	27
Illinois-Eastern	150	4	10
Rocky Mountain	263	12	— 32
Pacific Coast	140		— 35
Total United States	2,612	—25	—201
Western Canada	192	— 9	35

WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 27, 1954

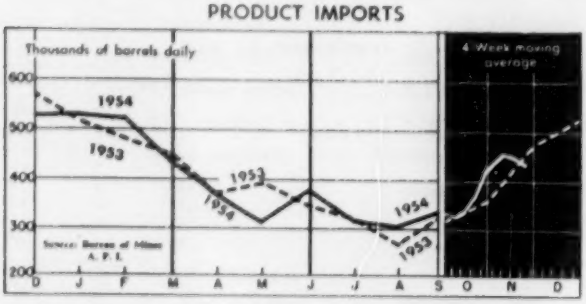
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1954	Cum. 1953	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1954: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	0	0	0	0	0	95	130	0	0	0	0	0	2	0	2	82	86
Arkansas	0	0	0	0	0	576	520	0	0	0	0	0	23	0	4	108	135
California	38	25	0	13	142,596	2,136	2,332	1	0	0	10	11	55	1	13	471	540
Colorado	26	6	2	18	140,427	1,204	655	0	0	0	14	14	33	0	17	507	557
Illinois	74	41	0	33	178,982	2,817	1,939	0	0	0	11	11	24	0	1	393	418
Indiana	16	7	0	9	30,312	775	1,208	0	0	0	4	4	9	0	1	187	197
Kansas	75	32	6	37	267,397	4,169	4,423	1	0	3	16	20	113	0	32	558	703
Kentucky	21	7	2	12	37,438	1,055	1,057	1	0	0	3	4	17	0	4	123	144
Louisiana	73	41	7	25	458,380	3,199	2,620	1	1	3	17	22	95	51	41	331	518
North	35	19	3	13	97,176	1,768	1,180	0	0	1	9	10	17	3	15	148	183
South	38	22	4	12	361,204	1,431	1,440	1	1	2	8	12	78	48	26	183	335
Michigan	10	5	0	5	26,539	516	568	0	0	0	5	5	15	0	0	193	208
Mississippi	6	3	0	3	47,690	386	365	0	0	0	1	1	10	1	0	144	155
Montana	9	3	0	6	48,017	310	404	0	0	0	5	5	6	0	2	104	112
Nebraska	3	0	1	2	14,348	391	291	0	0	0	1	1	23	0	3	124	150
New Mexico	26	11	9	6	123,664	995	1,330	1	0	0	5	6	20	3	20	98	141
Northwest	12	0	9	3	41,971	339	581	0	0	0	3	3	4	0	18	43	65
Southeast	14	11	0	3	81,693	656	749	1	0	0	2	3	16	3	2	55	76
North Dakota	4	1	0	3	28,726	277	245	0	0	0	1	1	5	0	0	103	108
Ohio	24	13	6	*5	54,625	1,057	1,015	0	0	0	0	0	3	0	5	14	22
Oklahoma	180	93	8	†79	684,954	8,085	6,877	2	2	0	22	26	120	7	23	610	760
Pennsylvania-New York	30	9	10	‡11	47,739	2,028	2,050	0	0	0	0	0	0	0	7	35	42
Texas	372	230	9	133	1,625,409	16,811	15,602	12	0	2	73	87	702	65	151	3,774	4,692
Southwest (1 & 4)	48	23	1	24	183,701	2,354	2,531	2	0	1	13	16	99	25	40	650	814
Gulf Coast (2 & 3)	48	20	2	26	316,110	2,406	2,294	1	0	0	16	17	74	32	44	610	760
East (5 & 6)	28	15	4	9	157,468	907	734	0	0	0	8	8	17	0	14	266	297
North Central (7-B & 9)	126	83	2	41	362,961	6,384	5,934	8	0	1	21	30	324	4	22	1,532	1,882
West (7-C & 8)	109	77	0	32	560,854	3,883	3,418	1	0	0	14	15	182	1	22	641	846
Panhandle (10)	13	12	0	*1	44,315	877	691	0	0	0	1	1	6	3	9	75	93
Utah	0	0	0	0	0	77	64	0	0	0	0	0	3	0	1	48	52
West Virginia	13	0	9	4	31,715	556	547	0	0	0	1	1	0	0	32	16	48
Wyoming	21	13	0	8	123,032	1,128	763	1	0	0	6	7	36	0	7	181	224
Miscellaneous (S. D.)	1	0	0	1	3,221	114	68	0	0	0	1	1	3	0	1	36	40
Total United States	**1,022**	540	69	413	4,115,211	48,757	45,073	20	3	8	196	227	1,317	128	367	8,240	10,052
Total previous week	1,042	547	80	415	4,065,772			56	1	10	240	307	1,297	125	359	8,044	9,825
Total November 28, 1953	1,008	593	69	346	3,959,773			28	1	8	167	204	1,309	99	333	8,341	10,082

Service wells included: *1, †24, ‡8.

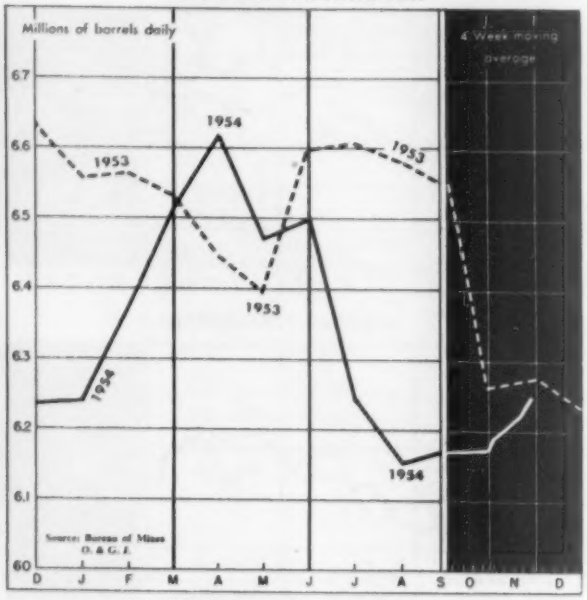
CRUDE IMPORTS



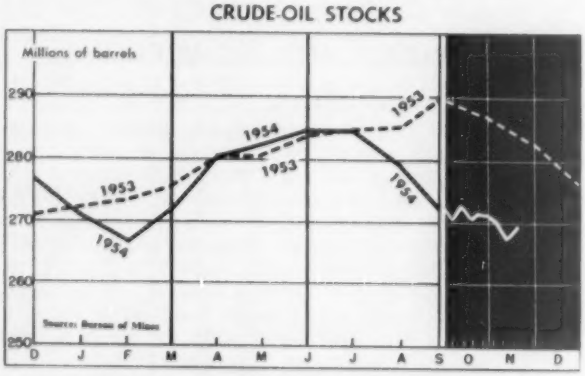
PRODUCT IMPORTS



CRUDE-OIL PRODUCTION



CRUDE-OIL STOCKS



DAILY AVERAGE PRODUCTION FOR WEEK

	November 27			Nov. 20
	Crude oil	Lease condensate	Total	total
Alabama	4,000		4,000	4,100
Arkansas	75,100	500	75,600	72,000
California	960,800		960,800	959,500
Colorado	141,600		141,600	142,800
Eastern	49,800		49,800	48,000
Florida	1,500		1,500	1,500
Illinois	188,400		188,400	188,300
Indiana	29,200		29,200	29,400
Kansas	325,000		325,000	321,800
Kentucky	39,400		39,400	38,000
Louisiana	587,800	43,800	631,600	631,400
North	101,800	2,800	104,600	104,400
South	486,000	41,000	527,000	527,000
Michigan	32,500		32,500	33,800
Mississippi	88,850	3,900	92,750	92,750
Montana	38,700		38,700	41,900
Nebraska	20,500		20,500	19,700
New Mexico	208,800	2,500	211,300	211,200
North Dakota	17,900		17,900	18,400
Oklahoma	506,100		506,100	511,900
Texas	2,598,300	50,375	2,648,675	2,648,675
Dist. 1	43,000	450	43,450	43,450
Dist. 2	133,000	7,700	140,700	140,700
Dist. 3	408,800	23,750	432,550	432,550
Dist. 4	228,000	5,650	233,650	233,650
Dist. 5	43,000	475	43,475	43,475
Dist. 6	109,700	5,025	114,725	114,725
East Texas field	210,500		210,500	210,500
Dist. 7-B	129,000	25	129,025	129,025
Dist. 7-C	172,000	4,600	176,600	176,600
Dist. 8	848,000	2,025	850,025	850,025
Dist. 9	189,300	625	189,925	189,925
Dist. 10	84,000	50	84,050	84,050
Utah	4,000		4,000	4,200
Wyoming	253,300		253,300	252,700
Others	‡200		‡200	400
Total U. S.	6,171,750	101,075	**6,272,825**	6,272,425
Change from previous week			**up 400**	
Canada	†283,700		†283,700	†285,277
Total U. S. production January 1-November 27			2,094,172,700 bbl.	
Same period last year (crude plus cond.)			*2,147,620,289 bbl.	

*Includes 29,998,950 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

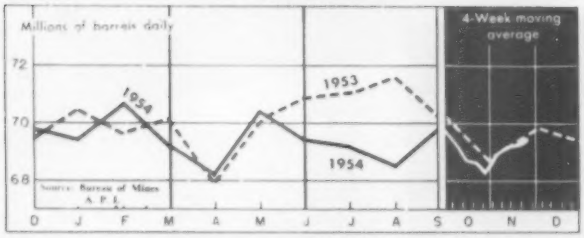
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

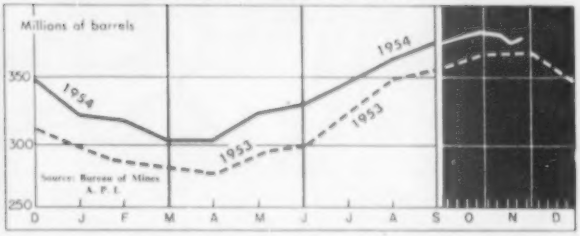
	Nov. 20, '54	Nov. 13, '54	Nov. 21, '53
Pennsylvania Grade	3,166	3,265	2,803
Other Appalachian	1,930	1,895	1,828
Illinois, Indiana, Michigan	12,411	12,717	12,660
Nebraska, North Dakota	2,073	2,129	(‡)
Kansas	8,561	8,527	8,905
Oklahoma	26,608	26,185	28,674
Arkansas	3,031	2,988	3,319
Louisiana	15,646	14,809	17,662
North	2,416	2,293	3,157
South	13,230	12,516	14,505
Mississippi	3,195	3,030	3,439
New Mexico	8,038	8,033	9,397
Texas	122,582	122,063	134,600
East Texas proper	10,387	10,753	11,985
West Texas	55,929	55,013	59,171
Texas Gulf	23,431	23,941	28,568
Other Texas	32,835	32,356	34,876
Wyoming	13,321	13,017	13,864
Other Rocky Mountain	6,135	6,118	3,131
California	31,317	31,923	32,808
Foreign	†11,665	10,350	11,684
Total	269,679	267,049	284,774

*Bureau of Mines. †Includes 3,581,000 bbl. in California. ‡Included with Kansas.

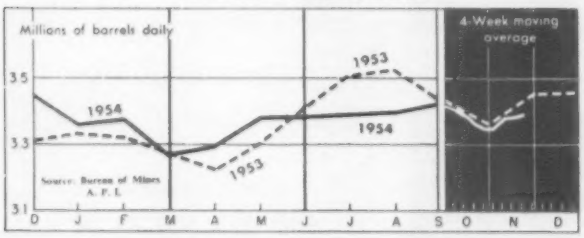
REFINERY RUNS



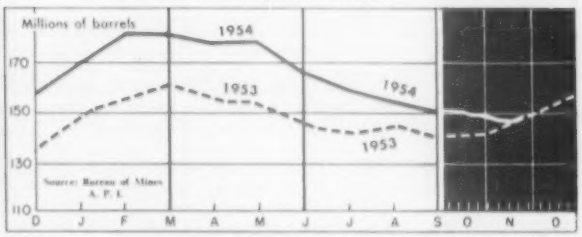
FOUR-PRODUCT STOCKS



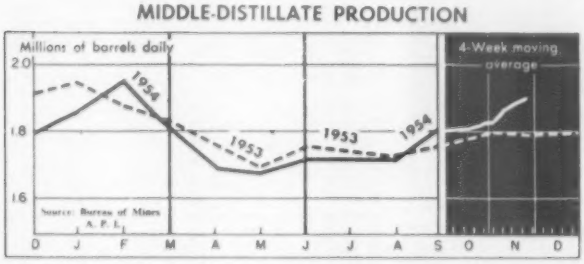
GASOLINE PRODUCTION



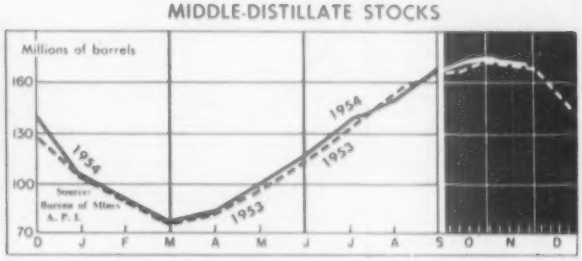
GASOLINE STOCKS



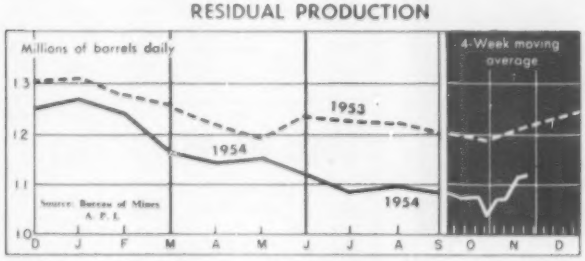
MIDDLE-DISTILLATE PRODUCTION



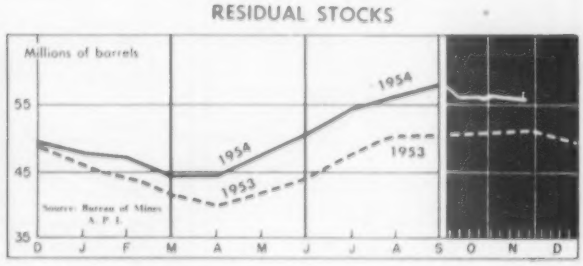
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



(Table for November 27 in News Section)

A.P.I. REFINERY REPORT, NOVEMBER 19

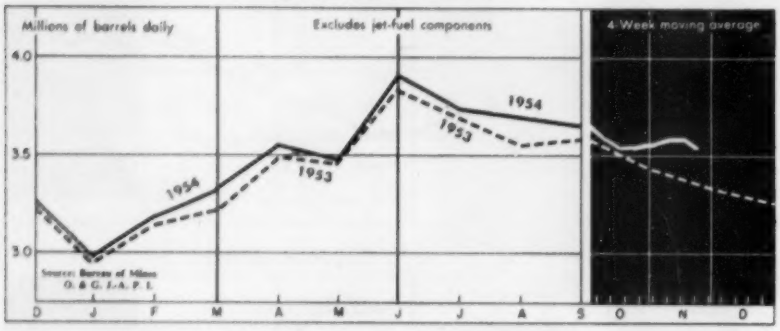
(Excludes all jet-fuel components)

(Thousands of barrels)

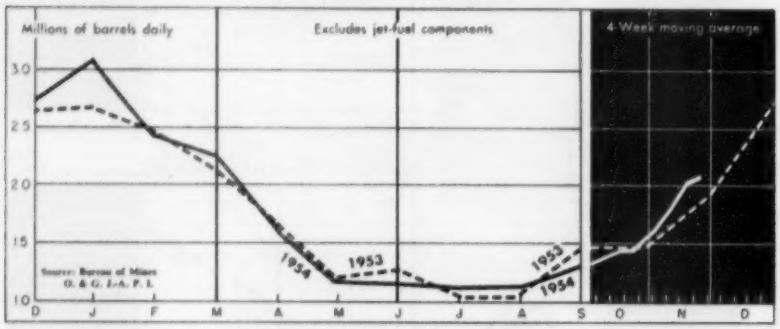
District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1953 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,055	446.3	27.1	260.3	217.8	33,762	14,218	50,934	10,072	1,028	436.8	34.4	247.0	217.2
Appalachian:														
District 1	93	44.8	5.1	20.3	3.1	4,180	698	2,765	428	115	51.7	6.5	24.6	12.5
District 2	71	30.7	4.7	8.9	7.9	2,338	457	799	305	88	45.2	5.7	14.5	11.9
Ind., Ill., Ky.	1,269	685.0	80.7	267.0	174.4	31,155	9,637	25,590	4,246	1,336	738.4	79.9	249.5	195.2
Okla., Kans., Mo.	635	351.3	21.3	143.4	40.3	13,110	2,306	12,647	1,386	592	351.3	17.0	133.1	50.3
Inland Texas	191	178.0	7.9	41.4	23.0	5,566	354	2,297	1,338	230	177.7	8.5	42.7	30.9
Texas Gulf Coast	1,681	789.0	119.4	438.6	226.9	20,592	3,789	17,557	5,787	1,692	826.4	123.0	402.2	243.8
La. Gulf Coast	597	282.0	69.6	168.2	38.3	9,510	3,430	5,058	1,484	552	282.8	60.9	124.7	47.0
N. La. and Ark.	90	33.6	6.7	25.6	6.1	3,905	702	1,798	138	88	37.7	8.5	20.1	7.2
Rocky Mountain:														
New Mexico	20	11.1		4.0	2.9	196		86	34	20	12.5	0.4	3.0	3.6
Other Rocky Mtn.	218	96.8	2.9	49.7	32.4	4,992	220	2,125	683	219	112.5	4.8	48.9	38.1
California	1,096	412.1	9.6	161.3	373.6	17,918	344	13,697	29,971	1,027	455.9	4.5	153.1	365.1
Nov. 19, 1954	7,016	3,360.7	355.0	1,588.7	1,146.7	147,224	36,155	135,353	55,872	6,987	3,528.9	354.1	1,463.4	1,222.8
Nov. 12, 1954	6,883	3,451.6	313.9	1,629.9	1,121.4	147,896	36,775	136,159	56,068					
Nov. 21, 1953	7,066	3,445.0	309.9	1,504.7	1,179.0	143,054	35,449	133,160	50,494					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

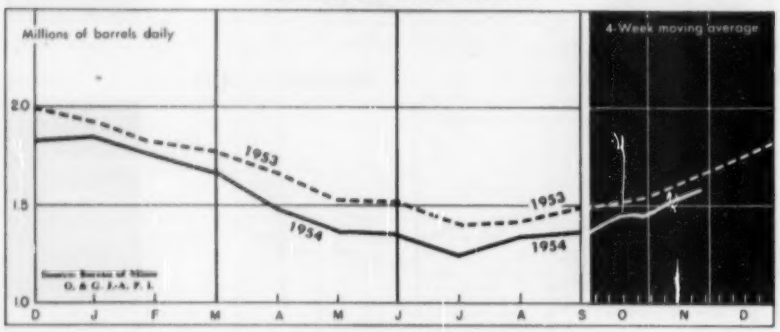
TOTAL GASOLINE DEMAND



TOTAL MIDDLE-DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of December 1, 1954. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.25-11	11.25-12	10.50-10.75
Premium gasoline	11.25-12	13-13.75	11.50-11.75
42-44 w.w. kerosine	9.125-9.25	10.10	9-9.25
No. 2 straw fuel oil	8.375-8.5	9.35	8.5
No. 6 residual	$1.35-1.45	$2.20-2.30	$1.85-1.95

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.5	5.0	5.25
Grade 18-55	6.6	6.1	6.35

LUBRICATING OILS
Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX
Mid-Continent

132-134 A.M.P.	6.0

• A better market tone in all of the principal products was reported in several refining and marketing centers over the past week. Residual fuels were particularly strong in the Mid-Continent and coastal areas. Improvement in inventory trends explained the firm gasoline prices in the Mid-Continent.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 11-26-54	3,389	3,530
August 1954	3,391	3,649
October 1953	3,359	3,423
November 1953	3,444	3,330
Middle distillate:		
Four weeks ended 11-26-54	1,905	2,070
August 1954	1,755	1,173
October 1953	1,795	1,479
November 1953	1,785	1,926
Residual fuel:		
Four weeks ended 11-26-54	1,121	1,572
August 1954	1,069	1,272
October 1953	1,184	1,521
November 1953	1,223	1,654

CRUDE PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.*	Okla-homa, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87			
15-15.9	1.93			
16-16.9	1.99			
17-17.9	2.05			
18-18.9	2.11			
19-19.9	2.18			
20-20.9	2.24	$2.50		$2.37
21-21.9	2.30	2.52		2.39
22-22.9	2.37	2.54		2.41
23-23.9	2.45	2.56		2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Includes New Mexico Permian.

Effective dates: California, February 16, 1953; east of California, June 15, 1953; Pennsylvania Grade, September 1, 1954.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.35
Middle District	3.25
Southwest Pennsylvania	2.93
West Virginia	2.82
Ohio	2.76
Illinois Basin	2.90-2.95-3.02

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5—C96 CONTINENTAL Engines, complete, and 1—Fairbanks-Morse ZC-346 Engine, complete. These engines purchased new in 1952, and are reconditioned and guaranteed. Priced to sell. Price on request. H. & H. Supply Co., Box 4173, Oklahoma City, Oklahoma.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

FOR SALE: New Wilson Giant—127' Mast, 18" Oil Well pump, Cameron Blowout preventor, 9,000' 4½" drill pipe. Can be seen operating on location in Oklahoma. Write Box H-528, The Oil and Gas Journal, Tulsa, Oklahoma.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

GASOLINE PLANT *FOR SALE*

Gasoline Plant, located in Brazoria County, Texas, shut down in January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Adequate storage tanks for all products. Drum Lead Blending Plant. Detailed inventory available upon request.

SOUTHERN PRODUCTION CO., INC.
P. O. Box 670, Ft. Worth, Texas

USED EQUIPMENT

Franks model 2000 Core Drill double drum drawworks; 40 ft. derrick; 5 x 8 pump; table, swivel, kelly, elevator, elevator links; mounted on 1946 International truck.

Franks SAL 4500 Skid Rotary Rig Cummins Power, 96' Derrick. Located, Tulsa, Oklahoma. O.C.S. Type 3 Servicing Unit mounted on 1942 Mack Truck. Located Odessa, Texas.

Write, Wire or Call
FRANKS MFG. CORPORATION
BOX 3218, WHITTIER STATION
TULSA, OKLAHOMA

FOR SALE EQUIPMENT

FOR SALE: Sullivan 200 complete with all tools ready to work. Located Tulsa, Okla. Contact R. F. Mesker, Phone 6-0057 or 5-9357, Tulsa.

FOR SALE: Wilson Titan—20" Gardner-Denver pump, 14" Gardner-Denver pump, 300-ton derrick equipment, Cameron Blowout preventor, 10,500' 4½" drill pipe. Can be seen operating on location in Oklahoma. Write Box H-529, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 1954 Cessna, 195, equipped w/ Lear Exec. ADF, VHF, LF Marker Beacon. Dual landing lights, cross wind gear. Less than 80 hrs. total time. This plane offered for sale due to purchase of Twin Beech. Herley Supply Co., 3040 Cherry Avenue, Long Beach 7, Calif. Phone L.B. 41687 or Nevada 62087.

1—MODEL RL 3-Drum Cardwell Powered with Buda Model 844D Diesel Engine. Rig and Engine in Perfect Condition. 1-87' 2-Pole Mast. Box H-404, The Oil and Gas Journal, Tulsa, Oklahoma.

GASOLINE AND CYCLING PLANT EQUIPMENT FOR SALE

Located in La Rosa Field, five miles south of Woodsboro, Texas, on Farm Road 1360. Plant shutdown in June, 1954. Bid sheets and inventory available upon request.

STANOLIND OIL AND GAS COMPANY
P. O. Drawer 1980
CORPUS CHRISTI, TEXAS

EQUIPMENT SPECIALS!

Columns: 8' x 28', 7' 6" x 56', 7' 4" x 70', 7' x 5' x 70', (2) 7' x 57' (400#), 7' x 42', 6' x 63', 5' x 62', 4' x 72', 4' x 47', (250#), 3' 6" x 63', 2' 6" x 60', 2' x 75', 2' x 45' (250#).

Heat Exchangers:

(5) 1,660 sq. ft. (Adm.), (2) 1,125 sq. ft. (850 lb.), 1000 sq. ft., 600 sq. ft. (Adm.), (5) 424 sq. ft. (Adm.), (5) 360 sq. ft., (4) 260 sq. ft.

60—Turbine driven centrifugal pumps, SS & Steel, 1" x 1" to 8" x 8".

2—6-stage Pacific pumps 730 GPM. 2,000 ft. hd.

2—Clark MA-4 150 BHP engines.

4 IR XVG-8 engines.

Goulds 16" 10,500 GPM. Pump. 135 ft. hd.

Oliver Filters: 8' x 10', 5' 3" x 8'.

5' x 12', 4' x 6' Drum Flakers.

Lab. Petrochem Furnace.

Detailed circular upon request.

BRILL EQUIPMENT COMPANY
4101 San Jacinto St., Houston 4, Texas, Locust 1351
New York Office, 2401 Third Ave.,
Telephone Cypress 2-5705
Sell us your surplus equipment

FOR SALE EQUIPMENT

ROTARY RIG COMPLETE: 2,500 to 5,000 ft. capacity. Easily Portable, 4½-in. drill pipe. Double derrick, 7-ft. substructure. Model "S" Cardwell drawworks, 14-in. Gardner-Denver pump powered by LRO Waukesha. Located Grady County, Okla. Now drilling near Duncan. R. V. Dillard, Phone 1177 or write Box 992, Duncan, Okla.

FRANKS MODEL J.E.T. 5000, Murphy Diesels. Rig complete with drill pipe. Perfect condition. Drilled less than 75,000 feet of hole. Willis Mevis, 317 Haberfelde Building, Bakersfield, California, FAirview 3-2450.

FOR SALE—250 KW Westinghouse Electric Generator Set, 300 hp Sterling Natural Gas engine, 440-220 V AC, unit steel base, excellent condition, reasonably priced. W. Caplis, Box 1312, Shreveport, Louisiana.

SWEET GASOLINE PLANT LIQUIDATION

HEAT EXCHANGERS—1530, 310, 265, 65, 26 sq. ft.

COLUMNS—84" x 30'; 72" x 28'; 72" x 16'; 60" x 24'; 48" x 24'; 42" x 44'; 36" x 42'; 24" x 45'.

TANKS—Storage & Pressure, 100 to 25,000 gal.

COMPRESSORS—14/11 x 20, 300 PSI; 14/12½ x 20, 175 PSI; 13" x 16", 75 PSI —all gas driven.

PUMPS—Centrifugal—1¼" to 8".

BOILERS—150 HP, gas fired, 150 PSI, HRT.

MISC.—Instruments, motors, stacks, pipe, etc.

Heat & Power Co., Inc.
310 Thompson Bldg., Tulsa 3, Okla.—
Phone: 3-4690
70 Pine St., New York 5, N. Y.—
HAnover 2-4690

FOR SALE

53 Million Cubic Feet Capacity Dehydration Unit
(NEW AS SHIPPED FROM FACTORY)

One complete BS&B Glycol Dehydration Unit—Regenerative equipment is skid-mounted and the two contractors are externally piped, requiring minimum labor for field erection. Dew point depression of 65° guaranteed by BS&B when handling 53 MMCF per day or less when inlet gas saturated with water vapor at 80° F. and 800 lb. psig. Maximum working pressure 1000 lbs. psig. Glycol carry-over loss guaranteed by BS&B not to exceed 0.1 gallons per million feet when operated at capacity.

Price 80% of cost,
f.o.b. Woodlawn, Texas

Woodlawn Processing Corporation
P. O. Box 4128, Centenary Station
Shreveport, Louisiana

FOR SALE EQUIPMENT

GAS METERS, Westcott and Foxboro orifice meters and controllers. Bristol recording pressure gauges. Geo. R. Milner, Box 124, Okmulgee, Oklahoma.

FOR SALE: 3600' 4½" extra hole drill pipe, good for shallow drilling. $.90 per foot. Terms. Melton Supply Company, Box 1360, Seminole, Okla.

CORE DRILLS—Acker Model for 150' coring $1835. Acker Model for 350' coring $2715. Acker Model for 800' coring $5410. Everything for well drilling. S. W. Pressey & Son, Pueblo, Colo.

U-15 WITH hydromatic brakes, powered by four 250 Horse Power Cummins diesel engines through hydraulic couplings with 127' Lee C. Moore mast, 4½" drill pipe, 6¼" drill collars. Oilwell 14P pump, mechanical Shaffer double BOP and all accessories for complete rig. First class operating condition. Rocky Mountains. Inventory on request. Box H-405, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—Horizontal Duplex Steam Pumps—10x8½x12—353 GPM—bronze fitted—max. discharge pressure 100 lbs.—6" suction—5" discharge—mfg. by American Marsh Co. Quantity available—NEW—Boston Metals Co. 313 E. Baltimore St., Baltimore 2, Md., Curtis 7-5050.

FOR SALE: Franks SAL 6000 Rotary, complete and ready for operation. Franks 96-ft. mast, 3-200 H.P. Cummins Diesel engines in excellent condition with V-Belt compounded. Gardner-Denver 7¼x16" Mud Pump with 6' fly wheel. 4-foot substructure, new 1500-foot 1⅛" drilling cable, 6400' of 3½" I.F. 15.5 Drill Pipe, 6 new Drill Collars 6¼"x30', one 8x5x29' Steel Mud Tank, Steel Dog House, Steel Pipe Racks, jets & lines, wrenches, fishing tools, etc. Rig located in Eastern Colorado. Contact Robinson Drilling Company, 1940 So. 11th East St., Salt Lake City, Utah, phone 7-0049, D. V. Robinson. Price: $60,000.00.

COMPLETE RIG: New U-15 Drawworks with four 250 Horse Power Cummins diesel engines through hydraulic couplings, hydromatic brakes on 127-foot 450,000-lb. Lee C. Moore mast and substructure, 8,000 Ft. 4½" Drill Pipe, 14 new 7" O.D. x 2⅞" Bore Drill Collars, new Emsco D-500 7½" x 16" pump, new Cameron twin hydraulic BOP, and all accessories. Good condition. Now drilling 8,000-ft. well in Rocky Mountain area. Inventory on request. Box H-403, The Oil and Gas Journal, Tulsa, Oklahoma.

FRANKS MODEL 5000—Bargain: 1-Cummins HBI-600 engine in good condition equipped with spudding attachment, skid and 65' double leg (8⅝ x 7" legs) mast. Call Amherst 73311 Wichita, or write P. O. Box 2001, Wichita, Kansas.

FOR SALE: 5000' rig. 1 250 Bethlehem complete drilling rig less derrick. 5000' drill pipe. Compound with two D-13000 Cats and 14 inch Bethlehem pump. Located: Wampler Bros., Box 1987, Longview, Texas. Phone PL 92312.

MAYHEW MODEL 2000 Drill, fully equipped and in good condition. Purchased new October 1953. For inventory and price, write H. M. Ramsey, P. O. Box 207, Robinson, Illinois.

FOR SALE: Franks Well Servicing Unit with mast on International KB-8 truck. McDaniel Well Service, Seminole, Oklahoma.

RENTAL TOOLS—Fishing and drilling—blowout preventers—shale shakers—Office and warehouse space. Nelson Sales & Rental Tool Co. 915 SE. 29th, Oklahoma City, Oklahoma. Phone MElrose 7-9366.

FOR SALE—Near Burrton, Kansas 3—100 HP single cylinder horizontal Clark engine compressor units with 16" x 20" Speitz overhead power cylinders, and 16" x 20" Clark compressor cylinders. Price, as is, $2500.00 each. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.

EQUIPMENT WANTED

WANTED—good used 4½", 20#, drill pipe. Give location, quantity and price—Sharp Drilling Company, Box 1271, Midland, Texas.

EQUIPMENT WANTED

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

EQUIPMENT NOT IN USE: Did you find a buyer in this column for the equipment you have for sale. Someone wants it and an "Equipment For Sale" classified advertisement in the Journal will find a buyer. See box heading for classified rates or write The Oil and Gas Journal.

WANTED
Engines and Compressors
Used Cooper-Bessemer JS 8, LS or LSV units, 1,000 H.P. or over.
Used Cooper-Bessemer GMV 10, GMW or M-Line Compressors.
Box H-486, The Oil and Gas Journal,
Tulsa, Oklahoma

HELP WANTED

PLATFORMER SUPERVISOR and Refinery Technologist: Leading Independent Refiner in Chicago area needs man to supervise 5500 bbl. Platformer operations. Also work on refinery problems in fractionation and absorption. Prerequisites, chemical engineering degree, experience as Platformer operator, familiarity with operation and design of gas concentration units. Send resume of education and experience, salary desired to Box 207, Blue Island, Ill.

GEOLOGIST, B.S., single, 4½ yrs. experience, 1 yr. Texas, 3½ yrs. Four Corners area in drilling, exploration, production of natural gas wells. Desires position with small independent. Box 542, Farmington, New Mexico.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2602, Tulsa, Okla. $5.00 cash.

HAVE OPENINGS for Chemical Engineers on pilot plant operations, with or without experience. Write Mid-Continent Petroleum Corporation, P. O. Box 381, Tulsa 2, Oklahoma.

ENGINEERS for aggressive manufacturing company in midwest. Graduate engineers or engineering background, in design or development work for control equipment, used in oil and gas production. Organization also needs sales engineers experienced in above lines. Company offers excellent benefits with salary review every six months. Salary range $5000 to $7000. Company pays our service charges. All information confidential. Send resumes to Chas. J. Loveless Personnel Service, 616 S. Main, Tulsa, Oklahoma.

THE RIGHT MAN: Can you fill the position you have open from the qualifications listed in this column. Men are always looking for an opportunity to improve themselves. Use a "Help Wanted" Journal classified advertisement to find the men you need. See box heading for classified rates or write The Oil and Gas Journal.

PETROLEUM ENGINEERS

Experienced graduate engineers or recent graduates, for immediate and future job openings in Saudi Arabia and New York City. For engineering work in development, production, drilling, process, and oil and gas engineering on primary and secondary recovery problems.

Salaries commensurate with education and experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 79

ARABIAN AMERICAN OIL CO.
505 Park Avenue, New York 22, N. Y.

EQUIPMENT WANTED

REFINERY MANAGER: Experienced foreign operations all phases modern refinery organization and management, labor and foreign government relations. U. S. Citizen. Box H-536, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY ENGINEER, M.S., 29, 6 years experience. Process design and project engineering with major contractor in foreign operations, also operating experience. Desire challenging foreign position with contractor or independent refiner. Box H-532, The Oil and Gas Journal, Tulsa, Oklahoma.

REGISTERED PETROLEUM ENGINEER, M.S. with seven years varied experience in oil production. Past three years in operating and evaluating water flood properties. Desire responsible position with aggressive independent or individual. Box H-516, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST—36, married; 14 years interpretational experience, including supervisory, with two contracting companies. Desires position as geophysicist with aggressive independent. Supervise crews, evaluate prospects and deals, review previous shooting, integrate geophysical with geologic programs. Box H-524, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING & PRODUCTION Supt., available, 20 yrs. experience Oil & Gas, 43 yrs. of age, married, sober, best of reference Box H-505, The Oil and Gas Journal, Tulsa, Oklahoma.

NO DRY HOLES if you wildcat with this advertising, sales promotion assistant who has creative and administrative experience in petroleum marketing. Currently working with plans, budgets, programs, policies for Tulsa-based regional company; wants bigger opportunity in bigger job with progressive petroleum marketer or other oil industry company. Family, 32, veteran, business and journalism grad. Will re-locate. Top references. Box H-525, The Oil and Gas Journal, Tulsa, Oklahoma.

THE POSITION YOU WANT: Oil Industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal.

EXPLORATION GEOLOGIST

Six years all around technical experience, surface, subsurface, geophysical, drilling, engineering, supervisory, administrative and consulting. Desires employment with an aggressive organization, major, small or individual.

Box H-535, The Oil and Gas Journal,
Tulsa, Oklahoma

Assistant to President

Energetic young oil company executive with drive and imagination, available as assistant to top executive. Ten years experience in petroleum and chemical industries includes sales management, refinery supervision, and position of Assistant to Vice President Manufacturing. MBA Harvard Business School; MS Chemical Engineering MIT. Resume on requests.

BOX H-527,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited.

Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY
P. O. Box 1628, Hobbs, New Mexico,
Phone 3-3141.
146 Allen Building, Midland, Texas,
Phone 2-2962.

SITUATIONS WANTED

RESERVOIR ENGINEER. Geologist—14 years experience in exploration, well completions, efficient production practices, Reservoir and G.O.R. Control, Pressure Maintenance, Re-pressuring, Gas utilization, Artificial lift, wishes to put these skills to work full-time for aggressive independent or as part-time consultant. Box H-530, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

WISH TO BUY producing royalties. Box H-379, The Oil and Gas Journal, Tulsa, Oklahoma.

JACK EAGLE, Oil Properties, 706 City Nat'l. Bld., Oklahoma City, Oklahoma. Telephone REgent 6-7027.

OFFERING CHOICE PRODUCING oil income royalties with large reserves per Dollar investments. A. S. Berry, 817 Wright Bldg., Tulsa, Okla.

GET TOGETHER: Both Capital and Royalties are available. If the investment proposition you want isn't listed in this column, use a Journal classified advertisement to find it. See box heading for classified rates, or write The Oil and Gas Journal.

LEASE AND DRILLING BLOCKS

DRILLING TO commence on multi-well project in known and producing oil field. Room for about 8 wells on drilling tract offered. Interests available from $275.00 to $2,000.00 to qualified individuals who want fast and good returns from their investment. Can be charged off either this or next year's income taxes or divided. Box H-533, The Oil and Gas Journal, Tulsa, Oklahoma.

HAVE EXCELLENT water flood project in North Texas. Will deal with parties capable of water flooding. Box H-534, The Oil and Gas Journal, Tulsa, Oklahoma.

200 ACRES for oil or gas development in Greenwood County, Kansas, offsetting old gas field which also produced oil. Geologically located on complete enclosure. Will sell or farm out on a drilling deal for small override. C. H. Barker, Box 91, Toronto, Kansas.

FOR SALE: 390 acre oil lease, Bartlesville Sand—600 ft., Eastern Kansas. Four producing wells making 15 bbl. daily production. Several proven locations to drill. Clarence Coffman, Wellsville, Kansas.

HAVE TWO 160 acre leases and need money to drill a Wilcox sand test, or farm out to good operator, structure is high and old wells had Wilcox oil at 3,450 ft. Lewis Short, Burrton, Kansas.

SEE A. L. BOWLES, Box 947, Ada, Okla., for drilling deals and producing royalties if you have the cash for Oil Investments.

Will pay cash instantly for lease (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

LOOKING FOR A LEASE? There will be over 40,000 wells drilled this year. If you are looking for a lease, drilling block, or drilling deal and you haven't found it in this column, or if you have a lease or drilling block you want drilled, a Journal classified advertisement can find an interested party. See box heading for classified rates, or write The Oil and Gas Journal.

LEASES ROYALTIES

Producing and Nonproducing
Bought and Sold—Any Area

Inquiries Invited

B. D. BUCKLEY
6635 Delmar Ave., St. Louis, Mo.

ELECTRIC LOG CABINETS

FOR ECONOMICAL FILING of full-size electric logs, most geologists prefer Kraftbilt E-24 4-drawer Electric Log Cabinet. Two compartments to each drawer with separate follow-blocks make this cabinet handy, economical. For filing reduced electric logs, geologists use Kraftbilt E-28 8-drawer cabinet. Send for Catalog 352-B. Ross-Martin Co., P.O. Box 800-A, Tulsa, Okla.

BUSINESS SERVICE

Delaware Corporations formed and serviced, American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

REAL ESTATE

OFFICE AND WAREHOUSE SPACE. Industrial or oil-field equipment preferred. Telephone, shipping, and receiving service. 915 SE. 29th, Oklahoma City, Okla. Phone MElrose 7-9366.

FOR SALE: Kiowa Oil Company Yard, approximately three acres at Great Bend, Kansas, consisting of: 1 Quonset Building, 100' long, 40' wide, 20'3" high; 2 room office in one end of building, all cement floor, modern. 1 one story duplex building, 4 rooms on each side with bath. 1 Tool shed, 16x30. 1 Tool Building 26x30. 10 Welded Casing Racks made out of 4" drill pipe. 1 Truck Garage, 31x61. Yard is enclosed with 8' Wire Mesh Fence. Contact Kiowa Oil Company, 717 Union National Bank Bldg., Wichita 2, Kansas; phone FO 3-8013.

SPACE IS NEEDED: A Journal display classified advertisement is the quickest way to rent or sell your real estate. In the present period of expansion oil industry firms urgently need the space you have available. If it isn't listed here, you may also find it by stating your needs in these pages. For classified rates see box heading or write The Oil and Gas Journal.

BUSINESS OPPORTUNITY

ADDITIONAL LINE wanted by small established firm, with history of steady healthy growth; experienced staff, warehouse facilities. Serves Southern California petroleum industry, including majors; drilling, production and refining divisions. Box H-513, The Oil and Gas Journal, Tulsa, Oklahoma.

RECENTLY ORGANIZED group seeking proven oil property with an income of $10,000 to $40,000 per month. You are writing directly to the principals. Prompt action. Box H-526, The Oil and Gas Journal, Tulsa, Oklahoma.

ACTIVE COMPANY desires to acquire oil and gas producing properties. All offers will receive full consideration and prompt attention. Box H-523, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

WANTED—IDEAS

Inventions that are related or can be adapted to the oil industry. We offer capital, technical advice, patent assistance, market research, a manufacturing plant, and a sales outlet; everything to put your invention on the market. Write P. O. Box 1665, Houston 1, Texas.

ESTABLISHED ORGANIZATION selling production, refining, marketing, Illinois-Indiana-Kentucky area seeks reputable lines. Box H-531, The Oil and Gas Journal, Tulsa, Oklahoma.

URANIUM

URANIUM

Purchasers wanted for uranium claims. Evaluated by our company at cost. We get no profit unless purchaser obtains production. Also, we offer a prospecting service with radiation surveys and diamond core drilling on a cost basis plus part interest in claims. Atomic Drilling and Exploration Co., Ltd. P. O. Box 1554—1223 Luisa—Santa Fe, New Mex. Phone 3-4757.

OIL FORMS

KRAFTBILT FORMS, designed especially for the oil industry, are popular because they are efficient, economical. For all production-reporting forms, plat sheets, all administrative forms, columnar pads, truck reports, material transfer forms, ask for Catalog 854-K. Ross-Martin Co., P. O. Box 800-A, Tulsa, Okla.

SOIL ANALYSIS

AT LAST, the secret of soil analysis in hunting for oil may be yours. Free details. Surfac Oil Surveys, 1414 Electric Bldg., Fort Worth, Texas.

Equipment Men

Hill, Hubbell Announces Denver Pipe-Coating Plant

Of interest to the pipe-protection industry is the announcement by Hill, Hubbell & Co. of its new plant in Denver. Located on a 20-acre site, the new Hill, Hubbell mill has been established to serve pipeline construction in the western United States.

Pipe from Colorado steel-pipe mills, as well as from the East and Far West will be processed in the new Denver plant, and delivered to construction projects throughout the western states.

According to M. M. Bowen, vice president and general manager of Hill, Hubbell, the new plant is a logical development in an area where pipe installations are steadily increasing in number. The present and potential growth in crude, natural-gas, and products lines, and the increase in water supply and public-utilities lines give importance to the new Hill, Hubbell factory.

Kim P. Ellis will manage the Denver plant with A. M. Sedar as assistant manager, and Bob Novak as process supervisor, according to Bryan Patterson, western manager for Hill, Hubbell operations.

Ethyl to Enlarge Research And Technical Facilities

Ethyl Corp. will spend over a million dollars in an expansion of its research facilities and technical services to the oil industry. The expansion will be undertaken at Ethyl's central research laboratories in Detroit and at its manufacturing center in Baton Rouge, La., according to an announcement by B. Bynum Turner, vice president in charge of research and engineering.

Major additions to laboratories will be made at both locations. Additional wings to house new engineering and chemical laboratories will be built at Ethyl's Detroit research laboratories. At the Baton Rouge plant, where the corporation's pilot plant and development laboratory are located, a new two-story addition will virtually double the present development laboratory.

The expansion program is related to a realignment of its research activities recently announced by Ethyl. Under the new organizational plan, the Detroit laboratories will be responsible for all research programs in the automotive products field while research and engineering on chemical products and on manufacturing processes will be concentrated in the Baton Rouge plant.

WILDCAT COMPLETIONS

(Continued from page 96)

NE NW SE 30-1n-4w. IPP 39 BOPD, Pickens 6,765-90 ft. TD 8,718 ft. (Oil discovery.)

KANSAS

Barber County: Purcell & Mull 1 Barkley, SE SE NE 10-32s-14w. IP 12,400 M.c.f. of gas per day, Viola 4,670-80 ft. TD 4,927 ft. (Gas discovery.)

Flynn Oil Co. 1 Rathgeber, C NE SE 31-34s-12w. IP 13,500 M.c.f. of gas per day, Miss. 4,782-88 ft., 4,800-25 ft. TD 5,566 ft. (Gas discovery, opens Hardtner pool.)

Barton County: Duke & Wood 1 Steinert, NW NW NW 23-16s-13w. Dry. TD 3,470 ft.

Butler County: Rex & Morris 1 Gouter, App. SE NE NW 30-28s-5e. Dry. TD 2,790 ft.

Rex & Morris 1 Zink, NE SW SE 29-29s-5e. Dry. TD 2,877 ft.

Cowley County: Fortier & Wright et al 1 Wilson, SE SE NW 13-30s-4e. Dry. TD 2,895 ft.

E. F. Wakefield 1 Parkerson, NE NW NW 35-30s-5e. Dry. TD 2,929 ft.

Ashton Oil Co. 1 Henderson, NW SW SE 34-31s-6e. IPP 17 BOPD, Layton 2,214-22 ft. TD 2,222 ft. (Oil discovery.)

Ellis County: Jones, Shelburne & Farmer 1 Mohler, NE NE SW 1-11s-19w. Dry. TD 3,710 ft.

Graham County: Anschutz 1 Knoll, SE SE NE 14-10s-25w. Dry. TD 4,529 ft.

Kingman County: Greenland Drilling Co. 1 Moorhouse, NW NW NW 20-28s-5w. Dry. TD 3,912 ft.

Rupp-Ferguson 1 Hartshorn, SE SW SW 36-29s-9w. IP 7,500 M.c.f. of gas per day, Miss. 4,161-70 ft. TD 4,700 ft. (Opens Zenda pool.)

McPherson County: John Allison 1 Allison, NW NW SW 35-19s-5w. Dry. TD 4,042 ft.

Fred Anschutz 1 Campbell, NW NW NW 5-20s-4w. Dry. TD 3,966 ft.

Morris County: Wm. Gruenerwald et al 1 Swenson, NE NW SW 3-17s-8e. Dry. TD 3,165 ft.

Pratt County: Rine Drilling Co. 1 Baker, NE NE NW 23-28s-14w. Dry. TD 4,646 ft.

Rooks County: Jones, Shelburne & Farmer 1 Nichols, NE NW SW 19-6s-20w. Dry. TD 3,894 ft.

Sedgwick County: Hal Redman 1 Harrison, NE NE SW 9-28s-2e. Dry. TD 3,384 ft.

Stafford County: NCRA 1 Jenkins, NE NE NE 15-25s-12w. Dry. TD 4,225 ft.

Thomas County: Derby Oil Co.-Van Grisso 1 Hills, SE SE SW 22-7s-34w. Dry. TD 5,020 ft.

NEBRASKA

Morrill County: E. L. Fundingsland 1 Brown, 44 ft. W of C NE NW 3-19n-52w. Dry. TD 5,552 ft. Red beds.

SOUTH DAKOTA

Jones County: Shell 2 Herman, C NW SE 3-1n-29e. Dry. TD 3,221 ft. Pre-Cambrian.

NORTH DAKOTA

Stutsman County: Calvert Exploration 1 Meyers, SE SW 25-137n-67w. Dry. TD 3,700 ft. Pre-Cambrian.

CALIFORNIA

Glenn County: Thornbury & Geis, Operator 78-7 Capco, 7-20n-2w. Dry. TD 2,950 ft.

Kern County: Intex Oil Co. 1-1 Voigt-Custodian, 4-28s-20e. Dry. TD 2,808 ft.

King Petroleum Co. 1 Hanawalt, 13-29s-27e. Dry. TD 2,885 ft.

E. C. Reid 1 Western, 13-29s-20e. Dry. TD 907 ft.

The Texas Co. 1 Arvin Unit-5 NW SW 24-31s-29e, IPF 130 BOPD, ⅛-in. choke, 34° gravity, 75 M.c.f. gas, perfs. 5,242-5,714 ft. in Chanac sand, TD 5,790 ft. (About ¼ mile east extension to Arvin area of Mountain View field.)

Trico Oil & Gas 1 Packwood, 15-25s-23e. Dry. TD 3,375 ft.

Kings County: Seaboard Oil Co. 22-G Gibson, 22-22s-19e. Dry. TD 4,000 ft.

San Luis Obispo County: C. W. Colgrove, 64-16 Mettler, 16-10n-25w. Dry. TD 2,321 ft.

Solano County: Parish Brothers 1 Well, 17-3n-2w. Dry. TD 2,288 ft.

Tulare County: Ajax Oil & Dev. Co. 1 Neal, 32-20s-26e. Dry. TD 2,750 ft.

Ventura County: Pacific Supply Co-op., Inc. 1 Natham, 23-5n-20w. Dry. TD 4,014 ft.

MONTANA

Big Horn County, East Tullock Creek: Mobil Producing Co. T-44-10-"I," SE SE NW 10-1s-36e. Dry. TD 8,335 ft. Cambro-Ordovician.

Blaine County, Turner area: Amerada 1 Halverson, C NW SE 4-5n-25e. Dry. TD 4,910 ft. Madison.

Phillips County: DeKalb Northern Oil Division 1 Gjersing, C SE NW 12-29n-31e. Dry. TD 4,439 ft. Nisku.

Teton County: Mule Creek Oil Co. 1 Rockport, SW SW SE 23-27n-7w. Dry. TD 3,800 ft. Mission Canyon.

Toole County: Tony Tomscheck 1 Tomscheck, SE NE NE 12-32n-4w. Dry. TD 840 ft.

WYOMING

Natrona County, Bates Hole: True & Brown 1 Klein-State, C NW SE 8-31n-81w. IPF

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110 BOPD, Frontier sand discovery, new field. TD 4,029 ft. Tensleep.

Burke Ranch: Carter 1 Anderson-McLeod Government, SE NW NW 33-37n-78w. Dry. TD 7,651 ft. Morrison.

Niobrara County: M. B. Armer and Pfister 1 Hammond-Government, SW SE NW 13-38n-61w. Dry. TD 2,750 ft. Triassic.

Park County, Deaver: True & Brown 1 State, C NE SE 36-57n-98w. Dry. TD 5,333 ft. Tensleep.

Sheridan County, Monarch: C. M. & W. Drilling Co. 2 Sheridan Coal Co., C SE SW 21-57n-84w. Dry. TD 5,719 ft. Shannon.

Dietz area: Bruno Montegna 1 Barbula, SW SW SW 25-57n-84w. Dry. TD 6,515 ft. Shannon.

Washakie County, Northwest Bud Kimball: Tide Water Associated Oil Co. 1 Government, C SW SW 3-45n-88w. Dry. TD 2,905 ft. Darwin.

COLORADO

Adams County: Gene Goff 1 UPRR, SW SW NW 27-3s-57w. Dry. TD 5,500 ft.

Potter Drilling Co.-Jos. E. Burke, Jr. and Jim Rose 1 Lee, C NW SE 32-1s-59w. Dry. TD 6,281 ft.

Arapahoe County: Sinclair 1 Deter, NE NE NE 22-5s-59w. Dry. TD 6,165 ft. Skull Creek.

Sinclair 1 Ludwick, NE NE NE 28-5s-60w. Dry. TD 6,490 ft.

Garfield County, Prairie Canyon: El Paso 1 Unit, NE NW SE 5-8s-104w. Dry. TD 4,240 ft. Entrada.

Logan County: New Drilling Co. and F. P. Zoch, Jr. 1 Hansen, C SW NE 1-7n-51w. Dry. TD 4,830 ft.

Shell 1 State 691, C NW SE 11-6n-52w. Dry. TD 4,707 ft. Dakota.

Vaughey & Vaughey 1 Leckler, C SE NW 28-11-55w. Dry. TD 5,737 ft.

Morgan County: H. C. Arnold and Calvert Drilling Co. 1 State-Berry, C SE NE 16-5n-56w. Dry. TD 5,645 ft.

F. Kirk Johnson 1 Yegge, C NW SW 28-3n-60w. Dry. TD 6,510 ft.

Trigood Oil Co. 1 Snyder-Thurman, C SW NW 7-4n-55w. Dry. TD 5,117 ft.

Paul Turnbull and New Drilling Co. 1 McGahan, SE SE SE 34-3n-58w. Dry. TD 5,943 ft.

Washington County: Braden-Hoover-Kjer and Stanolind 1 Kehr et al, C NW NW 26-3s-56w. Dry. TD 5,239 ft.

Weld County: McDowell-Calvert Drilling 1 Ecker, C NE NE 6-9n-56w. Dry. TD 6,085 ft.

MANITOBA

Cleary 15-22 Wilson, LSD 15, 22-5-28w1. Dry. TD 3,100 ft.

Sapphire 8-1 North Griswold, LSD 8, 1-10-23w1. Dry. 1,977 ft.

Sapphire 12-24 South Pipestone, LSD 12, 24-6-26w1. Dry. TD 3,007 ft.

SASKATCHEWAN

Canada Southern-Shell 14-9 Arena, LSD 14, 9-2-25w3. Dry. TD 4,450 ft.

Amurex-Canada Southern 1-16 English, LSD 16, 14-13-25w3. Dry. TD 3,620 ft.

Amurex-Trans Empire-Coop 1-10 Forest, LSD 10, 27-9-24w3. Dry. TD 5,220 ft.

Hudson's Bay-Canada Southern 6 Denzil, LSD 13, 24-39-26w3. Dry. TD 2,345 ft.

Seaboard 6-32 Devils Lake Crown, LSD 6, 32-27-5w2. Dry. TD 1,600 ft.

Amurex-Canada Southern 1-1 Rust, LSD 1, 12-16-27w3. Dry. TD 3,399 ft.

Socony-Sohio 28-10 Hutford, LSD 10, 29-30-19w3. Dry. TD 2,580 ft.

Socony-Woodley-Southern 20-5 Southeast Midway, LSD 5, 20-14-19w3. Indicated Upper Shaunavon oil well. TD 3,720 ft.

Tide Water 14-22 North Wapella Crown, LSD 14, 22-15-1w2. Dry. TD 3,110 ft.

ALBERTA

Chamberlain 6-10 East Buffalo, LSD 6, 10-21-5w4. Sunburst gas well. TD 3,133 ft.

California Standard 6A Grassy Island Lake, LSD 11, 3-33-6w4. Dry. TD 2,729 ft.

Mid Western B6-36 Majeau, LSD 6, 36-56-4w5. Dry. TD 4,303 ft.

Homestead-Admiral Territories 2 Stanmore, LSD 6, 3-31-11w4. Dry. TD 3,080 ft.

Amerada "AE" 9-8 Crown, LSD 9, 8-67-23w5. Triassic gas well. TD 11,045 ft.

Dome-Imperial 6-27 Westlock, LSD 6, 27-59-27w4. Viking gas well. TD 3,329 ft.

BRITISH COLUMBIA

Pacific 39 Fort St. John, LSD 6, 7-85-20w6. Triassic gas well. TD 6,889 ft.

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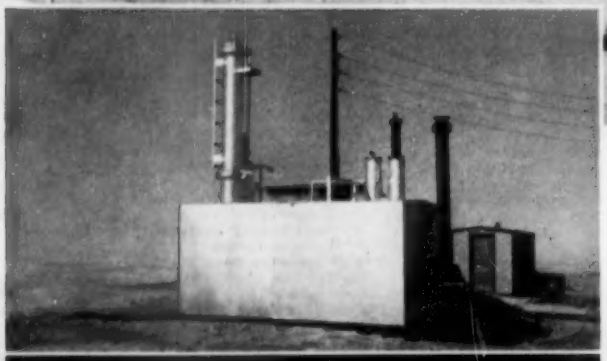

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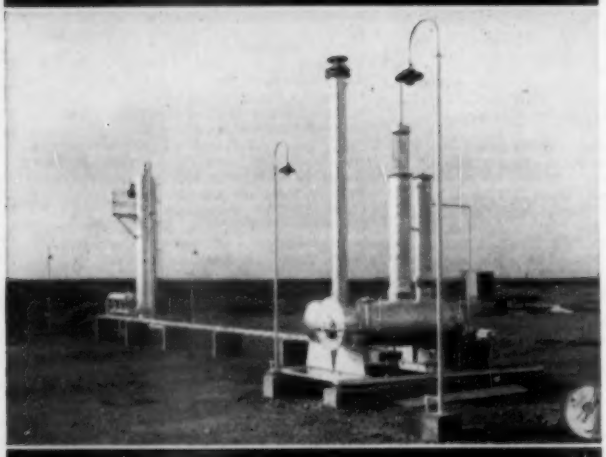

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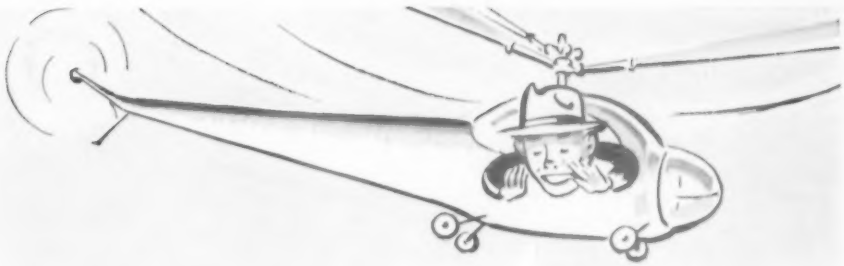

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